C
IZg1Ia
1914/15-1915/16

THE UNIVERSITY

OF ILLINOIS

LIBRARY

C
IZgIIa
1914/15-1915/16
cop. 2

C
LZg1Ia
314-15 cop2

UNIVERSITY OF ILLINOIS BULLETIN

VOL. XI. MAY 4, 1914 No. 36

[Entered February 14, 1902, at Urbana, Illinois, as second-class matter under Act of Congress of July 16, 1894.]

23592
22 24

THE GRADUATE SCHOOL

Of The

UNIVERSITY OF ILLINOIS

1914-1915

PUBLISHED BY THE UNIVERSITY
URBANA, ILLINOIS

[Ed. Je. 1, 5,000]

THE UNIVERSITY OF ILLINOIS

THE STATE UNIVERSITY

THE UNIVERSITY INCLUDES

The Graduate School, which offers courses of graduate study in all departments of the University.

College of Liberal Arts and Sciences.

College of Engineering (Architecture, Civil Engineering, Municipal and Sanitary Engineering, Electrical Engineering, Mechanical Engineering, Railway Engineering).

College of Agriculture (Animal Husbandry, Agronomy, Dairy Husbandry, Horticulture, Veterinary Science, Household Science).

College of Law (Three years' course).

College of Medicine (Chicago).

College of Dentistry (Chicago).

Schools—Commerce, Education, Music (*Piano, Voice, Violin*), *Library Science, Pharmacy* (Chicago), *Railway Engineering and Administration.*

Summer Session of eight weeks, held each summer.

United States Agricultural Experiment Station, the State Laboratory of Natural History, the Engineering Experiment Station, the State Geological Survey, the State Water Survey, Mine Rescue Station, connected with the University, all offer unusual facilities for research.

The Libraries at Urbana contain 251,000 volumes and more than 50,000 pamphlets.

For catalogs and information address

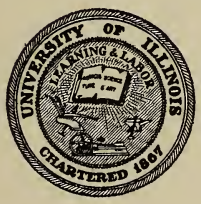
The University Registrar,
Urbana, Illinois

THE GRADUATE SCHOOL

Of The

UNIVERSITY OF ILLINOIS

Announcement For
1914-1915



PUBLISHED BY THE UNIVERSITY
URBANA, ILLINOIS

Digitized by the Internet Archive
in 2013

http://archive.org/details/universityofill416univ

C
IZ 61Ia
1914/15-1915/16
cop. 2

CONTENTS

Board of Trustees 5
University Calendar 6
Executive Faculty 8
History and Organization 9
Admission 9
Registration 10
  Residence 12
Character of Graduate Work 12
Master's Degrees 12
  In Arts and Science 12
  In Engineering 13
The Doctor's Degree 15
  Period of Study 16
  Examinations 16
  Thesis 17
Scholarships and Fellowships 18
  Research Engineering Fellowships 19
Libraries 20
Fees and Expenses 22
Graduate Club 22

Departments of Instruction 23
  A. Language and Literature 23
    Classics 23
      Greek 23
      Latin 24
      Philology 27
    English 27
      Literature, Language 30
      Rhetoric 31
    Germanic Languages 31
      German 31
      Scandinavian 34
    Romance Languages 36
      French 36
      Spanish 39

531785

B. History and the Social Sciences 40
Economics 40
History 44
Political Science 50
Sociology 53
C. Education, Philosophy and Psychology 55
Education 55
Philosophy 59
Psychology 60
D. The Sciences Including Mathematics 62
Astronomy 62
Bacteriology 62
Botany 63
Ceramics 65
Chemistry 66
Entomology 75
Geology 77
Household Science 80
Mathematics 80
Physics 87
Physiology 91
Zoology 92
E. Engineering 97
Architecture 98
Civil Engineering 99
Electrical Engineering 99
Mechanical Engineering 100
Mechanics, Theoretical and Applied 102
Mining Engineering 103
Municipal and Sanitary Engineering 104
Railway Engineering 104
F. Agriculture 106
Agronomy 106
Animal Husbandry 107
Dairy Husbandry 110
Horticulture 111
Index 113

BOARD OF TRUSTEES

THE GOVERNOR OF ILLINOIS.....*Ex Officio*
EDWARD F. DUNNE.....Springfield
PRESIDENT OF THE STATE BOARD OF AGRICULTURE.*Ex Officio*
JOHN T. MONTGOMERY.....Charleston
THE SUPERINTENDENT OF PUBLIC INSTRUCTION..*Ex Officio*
FRANCIS G. BLAIR.....Springfield

	TERM EXPIRES
ARTHUR MEEKER, Union Stock Yards, Chicago	1915
LAURA B. EVANS, Taylorville	1915
ALLEN F. MOORE, Monticello	1915
WILLIAM L. ABBOTT, 120 Adams Street, Chicago	1917
OTIS W. HOIT, Geneseo	1917
MARY E. BUSEY, Urbana	1917
ELLEN M. HENROTIN, 743 Lincoln Parkway, Chicago	1919
JOHN R. TREVETT, Champaign	1919
FLORENCE E. WATSON, Effingham	1919

OFFICERS OF THE BOARD

WILLIAM L. ABBOTT, 120 Adams Street, Chicago.....
.....President
HARRISON E. CUNNINGHAM, Urbana.....Secretary
MATTHEW W. BUSEY, Urbana.....Treasurer
GEORGE E. FRAZER, Urbana.....Comptroller

THE UNIVERSITY CALENDAR
1914-1915

As Applicable to the Graduate School

First Semester, 1914-1915

1914

Sept. 21, 22, Monday, Tuesday	Registration days
Sept. 23, Wednesday, 8 a. m.	Instruction begun
Nov. 2, Monday, 5 p.m.	Latest day for announcement of subjects for graduate theses
Nov. 25, Wednesday, 12 m.	Thanksgiving recess begun
Nov. 30, Monday, 12 m.	Instruction resumed
Dec. 2, Wednesday	Illinois Day
Dec. 22, Tuesday, 5 p. m.	Holiday recess begun
Dec. 31, Thursday, 5 p. m.	Latest day for submission of outlines of theses by candidates for professional degrees in engineering

1915

Jan. 4, Monday, 12 m.	Instruction resumed
Jan. 28, Thursday	Semester examinations begun
Feb. 4, Thursday	Semester examinations ended

Second Semester, 1914-1915

Feb. 8, 9, Monday, Tuesday	Registration Days
Feb. 10, Wednesday, 8 a. m.	Instruction begun
Feb. 12, Friday	Lincoln Day
April 1, Thursday, 5 p. m.	Latest day for filing of completed theses by candidates for professional degrees in engineering

April 1, Thursday, 12 m.	Easter recess begun
April 6, Tuesday, 12 m.	Instruction resumed
May 15, Saturday, 12 m.	Latest day for receipt by the Dean of the Graduate School of certified copies of doctors' theses
June 3, Thursday	Semester examinations begun
June 5, Saturday, 12 m.	Latest day for receipt by the Dean of the Graduate School of certified copies of masters' theses
June 10, Thursday	Semester examinations ended
June 13, Sunday	Baccalaureate address
June 15, Tuesday	Alumni Day
June 16, Wednesday	Forty-fourth Annual Commencement

THE EXECUTIVE FACULTY

EDMUND JANES JAMES, PH. D., LL. D., PRESIDENT OF THE UNIVERSITY.

DAVID KINLEY, PH. D., LL. D., *Dean and Professor of Economics.*

BOYD HENRY BODE, PH. D., *Professor of Philosophy.*

ALBERT PRUDEN CARMAN, A. M., SC. D., *Professor of Physics.*

JULIUS GOEBEL, PH. D., *Professor of Germanic Languages.*

GEORGE ALFRED GOODENOUGH, M. E., *Professor of Thermodynamics.*

HARRY ALEXIS HARDING, Ph. D., *Professor of Dairy Bacteriology.*

LAURENCE MARCELLUS LARSON, Ph. D., *Professor of History.*

HERBERT WINDSOR MUMFORD, B. S., *Professor of Animal Husbandry.*

WILLIAM ABBOTT OLDFATHER, PH. D., *Associate Professor of Classics, Secretary.*

STUART PRATT SHERMAN, PH. D., *Professor of English.*

ARTHUR NEWELL TALBOT, C. E., *Professor of Municipal and Sanitary Engineering.*

EDGAR JEROME TOWNSEND, PH. D., *Professor of Mathematics.*

HENRY BALDWIN WARD, PH. D., *Professor of Zoology.*

EDWARD WIGHT WASHBURN, Ph. D., *Professor of Physical Chemistry.*

HISTORY AND ORGANIZATION

Although for many years the University of Illinois had offered advanced students facilities for study and research in various lines, graduate work was undertaken under the name of the Graduate School for the first time in 1892. In 1894 the administration of the school was vested in the Council of Administration, and the Vice-President of the University became Dean of the School. In 1906 the Graduate School was organized as a separate faculty, consisting of a dean and members of the University faculty assigned to this duty by the President. No means of support were provided, however, separate from those provided for the undergraduate work. In the winter of 1906-7, the Forty-fifth General Assembly of the State passed an act appropriating $50,000 per year for the support of a Graduate School of Fine Arts and Sciences in the State University. This appropriation has been continued by succeeding Legislatures.

By act of the Trustees the teaching faculty of the Graduate School includes all members of the University faculty who give instruction in courses approved for graduate credit. The affairs of the School, however, are in charge of the executive faculty appointed each year by the President.

ADMISSION

Admission to the Graduate School of the University of Illinois is substantially admission to candidacy for the master's degree. That is to say, no applicant is admitted unless his previous education has been such that he is fully prepared to undertake work of graduate character, so that, assuming him to have had the specific prerequisites for his major subject, he can expect to get his master's degree in one year. Applicants are not admitted if their previous education is such that, aside from the specific prerequisites for their major study, the performance of the work necessary for attaining the master's degree in one year is impossible or highly improbable. Therefore, for admission to the Graduate School to work for a degree an applicant must hold a first degree either from the University of Illinois or from some other university or college of equivalent standing. Admission to particular graduate courses or depart-

ments may be secured only by those who have had the requisite undergraduate work in those courses or departments.

In order to be enrolled as a member of the Graduate School a student must be doing graduate work. The possession of a first degree does not entitle a student to be enrolled in the Graduate School, if the courses which he is taking are undergraduate.

Students of mature age who do not hold a first degree, but satisfy the dean of the school and the officers of the departments in which they wish to work of their earnestness of purpose and special fitness, may be permitted to take work in the Graduate School without reference to candidacy for a degree. In order to secure this permission, however, a candidate must have had such preliminary preparation for the work he wishes to take up as would justify his admission to the Graduate School as a candidate for a degree if he could meet the other requirements fully.

Application blanks may be secured from the Dean of the Graduate School or from the Registrar of the University.

REGISTRATION

After the student's application for admission has been approved, he receives at the Dean's office a permit to register and also a study blank. This study blank must be filled out with the advice of the professors in charge of the selected work.

The person in charge of the major work of the student becomes his adviser, and, together with those with whom the student is taking first and second minor courses, forms a committee with general supervision over the student's general course of study. The chairman of this committee is expected to follow the student's work and see that he is helped to lay out an intelligently planned course, and to give him such advice as may be necessary concerning his scholastic career.

Each student is required to attend a minimum of four class, lecture, or laboratory, exercises, per week, in the first year of his graduate study; and in no case is he permitted during his course to attend more than twelve per week.

Each first year student doing full work must take at

least four unit courses. A unit course is one which requires ten hours of time per week through one semester, irrespective of the mode of distribution of that time in class work, laboratory work and private study. Four such courses or their equivalent constitute a full minimum program for one semester, and eight such courses, or their equivalent of graduate grade, constitute the minimum year's work required for a master's degree.

Therefore, registration for full work for the master's degree ordinarily provides for three unit courses, or their equivalent, per semester, in addition to a thesis, the time devoted to the thesis being ordinarily reckoned as equivalent to that for one unit course, or ten hours of time a week. If a student is excused from writing a thesis he must take four unit courses or their equivalent per semester.

Unless otherwise specified by the department concerned, a course for graduates and advanced undergraduates, not open to students below senior grade and counting four or five hours of undergraduate credit, if taken by graduate students, will be treated as a unit course; when counting less than four hours of undergraduate credit, such a course, if taken by graduate students, will be treated as a half-unit course.

Unless otherwise specified by the department, a course the prerequisites of which are such as to make it possible for juniors or sophomores to be admitted if taken by a graduate student, is counted as a half-unit course, or a quarter-unit course, according to the number of hours of undergraduate credit for which the course is given.

Graduate students are permitted under proper circumstances to attend classes as visitors and to elect miscellaneous subjects which do not count toward their degree. Under the authority conferred by the faculty on the Dean no student who is carrying full work as herein described will be permitted by the Dean to visit more than one class or to take more than one miscellaneous subject.

The above regulations concerning the program of studies are laid out primarily for first year students. Second and third year graduate students fill out their programs irrespective of unit value, according to their needs, under the advice of their instructors. The work of second and

third year graduate students is arranged in quantity and character with sole reference to prospective candidacy for a doctor's degree.

Assistants and others on the University staff who undertake to do graduate work are permitted to take an amount of work determined by the terms of their employment. Such a student, applicant for a master's degree, must ordinarily stay through at least two years. In no case will the doctor's degree be conferred upon an applicant otherwise fit in less than four years if he is on the staff in any capacity.

Residence.—Continuous residence and study are required of all members of the Graduate School, unless they are granted leave of absence by the Dean, upon recommendation of the professors in charge of their work, for the purpose of carrying on elsewhere studies or investigation in the line of work for their degrees.

CHARACTER OF GRADUATE WORK

The principal aim of graduate study is the development of the power of independent work and the promotion of the spirit of research. Each candidate for a degree is expected to have a wide knowledge of his subject and of related fields of work; for the graduate student is not expected to get from lecture and laboratory courses all the knowledge and training necessary to meet the requirements for his degree.

Students are warned against restricting themselves merely to the courses prescribed or suggested by the departments in which they are studying. Each student is expected to do a wide range of private reading and study, and in many cases will find it advisable to take one or more courses of lectures quite outside the field of his chosen subject.

THE MASTER'S DEGREES

Candidates for the degree of Master of Arts or Master of Science are required to do at least one year's work in residence and to write a thesis.

A candidate for a master's degree may do all his work in one subject, or he may select a major and one minor, or a major and two minors. A major or minor denotes the

field of knowledge of a department, or such part thereof as constitutes a separate and independent division of that field. The candidate must do at least half his work in his major subject.

Each candidate for a master's degree is also required to present a thesis on some subject approved by the professor in charge of his major work and the faculty of the School. The requirement of a thesis may be waived, however, upon the recommendation of the head of the department in which the student is doing his major work, and the approval of the Dean, provided application to waive the thesis is made at the beginning of the year. *In no case will permission to take the degree without the thesis be given if applied for later than the latest date for the approval of thesis subjects, as shown by the calendar.*

The thesis required from a candidate for a master's degree ordinarily will demand about one-fourth of the student's time. The thesis must be typewritten, on "thesis paper," and the title-page must be printed. The thesis in its final form, together with a certificate of approval by the proper officer, must be left by the professor in charge at the Dean's office at the time set in the calendar.

Credit for work done elsewhere is not "transferred." The candidate is examined here on all the work required for the degree.

Students should note, moreover, that all the work for the master's degree must be done in residence, excepting in the case of members of the staff who have spent half of their time in study through a year at some other institution, and then do the rest of the work required during a year's residence here.

The Master's Degree in Engineering

Two classes of second degrees are open to graduates of the College of Engineering, namely, academic and professional.

The academic second degree in engineering is Master of Science, following Bachelor of Science, in Architecture, Architectural Engineering, Civil Engineering, Electrical Engineering, etc. This degree is conferred in accordance with the regulations described above for *academic work in residence only.*

The *professional* second degrees in Engineering are as follows:

Master of Architecture after B. S. in Architecture.

Architectural Engineer after B. S. in Architectural Engineering.

Civil Engineer after B. S. in Civil Engineering or B. S. in Municipal and Sanitary Engineering.

Electrical Engineer after B. S. in Electrical Engineering.

Mechanical Engineer after B. S. in Mechanical Engineering.

Civil Engineer, Electrical Engineer or Mechanical Engineer, after B. S. in Railway Engineering, according to the course.

Professional degrees are conferred upon two classes of candidates: (1) graduates of the College of Engineering of the University of Illinois who have been engaged in acceptable professional work away from the University for a period of not less than three years after receiving the degree of Bachelor of Science; (2) graduates of the University of Illinois, or of institutions of equal standing, who have been engaged in acceptable professional work in residence at the University for a period of not less than three years after receiving the degree of Bachelor of Science.

In "acceptable professional work" may be included contributions to technical literature, activity in professional societies, investigation of engineering problems, and the teaching of engineering subjects.

A candidate must declare his candidacy and file with the Dean of the College of Engineering, as chairman of the committee in charge, a detailed statement covering his professional study and experience, not later than the first Monday in November preceding the commencement at which he proposes to qualify. Prior to December 31 next succeeding, he must submit for approval an outline of his proposed thesis and he must file his completed thesis not later than April 1. If the statement of professional experience and study and the thesis are accepted, the candidate must present himself at commencement in order to receive the degree.

Candidates for professional engineering degrees who already hold the degree of Master of Science, may qualify

for the professional degree after two years of professional work.

A candidate for a professional engineering degree must pay the incidental fee of twenty-four dollars on being notified that his professional study and experience are accepted as qualifying him to enter as a candidate for the degree. No one will be enrolled as a candidate for the degree at the following commencement who does not pay his fee at this time. When a candidate for a professional engineering degree has once been accepted and paid his fee, he is eligible to receive the degree at any time within five years, without additional fee, on completion of the requirements; provided, however, that unless he completes the requirements within two years his name will be dropped from the list of candidates and in order to receive the degree within the five-year period he must register once more.

THE DEGREE OF DOCTOR OF PHILOSOPHY

General Statement of Requirements.—The requirements for the degree of Doctor of Philosophy are a thorough mastery of a selected field of study, evidence of the power of independent investigation in this field, a broad knowledge of the wider field of study of which this major subject is a part, a general acquaintance with related fields of knowledge and a mastery of all branches of study which are necessary to a full knowledge of the main subject. Each student who is seeking this degree is expected to choose for study and final examination a major subject, or field of study, and a first and second minor. The major subject is the field in which the student expects to become expert and an authority. The first minor should ordinarily be a subject closely related to the major and, under certain conditions and with proper approval, may be a subdivision of the major field of study. The second minor should be chosen outside of the major field of study.

When a candidate chooses any subject as his major, and a division of that subject as his minor, he is not permitted to choose as a second minor any division of work in that same department, excepting by vote of the executive faculty of the School.

The candidate's list of subjects must receive the appro-

val of the head of the department in which he chooses his major work and of the Dean of the School.

Period of Study.—The *minimum* period of study required for securing the degree of Doctor of Philosophy is three years. The degree is conferred, however, not for residence during a certain period, but for scholarly attainments and power of investigation, as proved by thesis and examinations.

Candidates should note that credit is not given for work done in other universities, excepting in the sense that their residence at other institutions is counted towards the residence requirement for the doctor's degree.

At least the first two or the last one of the three years required must be spent at this University.

Examination.—Towards the end of his second year of study, or, by special permission, at the beginning of his third year, the candidate for the degree must submit to a preliminary examination conducted by the members of the faculty with whom he is doing his principal work, in order to determine whether he will be accepted as a candidate for the degree in the following year. This examination is partly oral, and may be wholly so. At this time, or before, the candidate will be required to demonstrate his ability to read French and German, and any other language needed for the prosecution of his work.

On or before the last Monday in May of the year in which the candidate expects to come up for his degree, he must submit to a final examination by a committee appointed by the Dean of the Graduate School. This examination will be partly written. The candidate will also have, however, an oral examination. These examinations will not be confined to the courses which the candidate has attended in the University of Illinois only, if he has done part of the work elsewhere; nor even to the field covered by the courses specifically taken in this or other universities; but will be so conducted as to determine whether the candidate has a satisfactory grasp of his major subject as a whole, and a general acquaintance with the fields of knowledge represented by his course of study.

Before the candidate is admitted to the final examination and the defense of his thesis, he may be required to take

any other examination, oral or written, that is thought proper by the various departments in which he has studied. If after having passed his preliminary examination, he fails in the third year of his study to meet the expectations of the professors in charge of his work, or in any way fails to maintain the standard of scholarship and power of research expected of him, he may be refused admission to the final examination.

The final examination in the major and minor subjects may not be divided. The examination must be taken all at one time even though it requires several sessions.

Credit for work done in other universities is not "transferred." The candidate is examined here on the subjects offered by him for the advanced degree. However, his period of residence at another institution of proper grade will be accepted as fulfillment of the residence requirement of the University of Illinois so far as it goes.

Thesis.—The power of independent research must be shown by the production of a thesis on some topic connected with the major subject of study. The candidate is expected to defend his thesis or dissertation before the members of the faculty, or as many of them as may wish to question him about it, in connection with his final examination.

The subject of the thesis should be chosen not later than the end of the second year of study and must be submitted for formal approval by the faculty not later than the first Monday of November of the year when the degree is expected. A typewritten copy of the complete thesis, on thesis paper, must be in the hands of the Dean not later than noon of the Saturday nearest the middle of May, for submission to the examining committee.

The doctor's thesis must be printed and one hundred copies deposited in the Library of the University not later than the first of June preceding the conferring of the degree. If it is not printed by the first of June, the student must deposit seventy-five dollars ($75) or a bond for that amount satisfactory to the Comptroller of the University and the Dean of the Graduate School. If a bond is accepted, it must be replaced at the end of one year with a cash deposit. At the end of two years, if the thesis has not

then been printed by the student, the University will print such part of it as it deems best.

The cash deposit made by the student who does not print his thesis by the end of the second year after his degree is conferred becomes the property of the University, to be used for the general purpose of printing theses, and all graduate students who receive their degrees must agree at the time when the deposit is made that the University shall become the owner of this deposit for this purpose.

The title page of each thesis must bear the words, "Submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in—(here put the major subject), in the Graduate School of the University of Illinois." The title page must also contain the full name of the author, the full title of the thesis, the year of imprint, and, if a reprint, the title, volume and statement of the pagination of the volume from which it is reprinted. Each thesis must have an appendix giving a short biography of the candidate, including the institutions he has attended, his degrees and honors, the titles of his publications, and such other matters as are pertinent.

SCHOLARSHIPS AND FELLOWSHIPS

A number of fellowships and scholarships have been established by the Trustees of the University. To first year graduate students of ability and promise there are open a number of scholarships with a stipend of $250 each and freedom from tuition, incidental and laboratory fees. To second and third year graduate students, that is, those who have had one or two years of graduate study, there are open fellowships with a stipend varying from $300 to $500, with freedom from fees. The larger stipends are given only to students who are expected to take their degrees within the year. Each holder of a fellowship or scholarship must pay the matriculation fee of ten dollars, unless he holds a first degree from the University of Illinois, and also the diploma fee of five dollars on receiving his diploma.

Candidates for these scholarships and fellowships must be graduates of the University of Illinois, or of colleges or universities having equivalent requirements for bachelors' degrees.

Application must be made upon blanks to be obtained from the Dean of the Graduate School. These application forms should be addressed to the Dean of the Graduate School as early as possible in February of the academic year preceding that for which the fellowship is desired.

Persons appointed are required to send the Secretary of the Board of Trustees prompt notice of their acceptance or refusal; and to agree that, if accepted, the appointment will not be resigned to take a similar one in any other institution during the year for which it is awarded.

Nominations to fellowships are made upon the grounds of worthiness of character, scholastic attainments, and promise of success in the principal line of study or research to which the candidate proposes to devote himself.

Scholarships and fellowships are good for one year, but may be renewed for a second or a third year in special cases. An appointment as honorary fellow, without stipend, may be made as specified for paid fellowships in the case of any one who has shown distinguished merit in his work.

Research Fellowships in the Engineering Experiment Station

The Engineering Experiment Station is devoted entirely to research. Its purposes are the elevation of engineering education, and the study of problems of special importance to engineers and to manufacturing, railway, mining, and industrial interests.

Ten research fellowships have been established in the Engineering Experiment Station. These fellowships are open to graduates of approved technical schools and universities, both American and foreign. There is a stipend of $500 a year for each fellowship. Applicants to whom these fellowships are awarded are required to agree to hold them for two years, devoting a part of their time to the work of the Engineering Experiment Station. At the expiration of this period, if all requirements have been met, the degree of Master of Science will be conferred.

Application for these fellowships should be made to the Director of the Engineering Experiment Station not later than February first. Candidates must present with their

applications full information concerning themselves, including any written or published papers or results of investigation.

LIBRARIES

The general University library, the library of the State Laboratory of Natural History, and that of the College of Law are all at the University in Urbana. The libraries of the School of Pharmacy and the Colleges of Dentistry and Medicine are in Chicago.

The University library contains 251,000 volumes and 50,000 pamphlets. The University has a subscription list of 1,300 periodicals. The Library of the State Laboratory of Natural History contains 7,450 volumes and 18,200 pamphlets. The library of the College of Law contains the Federal and State Reports, the leading textbooks, and a line of leading periodicals, aggregating more than 14,000 volumes.

The general library of the University is open daily, from 8 a. m. until 10 p. m. and on Sunday from 2 p. m. to 6 p. m.

The Mason Historical Library.—The valuable library of western history collected by Edward G. Mason, Esq., long president of the Chicago Historical Society, is in the Public Library of the city of Champaign, and is accessible to University students.

The Dittenberger Classical Library.—The University possesses the library of Wilhelm Dittenberger, at one time Professor of Classical Philology in the University of Halle. This library contains 5,600 items and is especially valuable for the literary study of the classical languages. It includes, in the best editions, the works of the poets and prose writers, both Greek and Latin, and numerous works on grammar and history of literature, with between four and five thousand dissertations and programs on special topics. In addition, there are many works dealing with the other departments of classical philology, as epigraphy, history of ancient peoples, archaeology, philosophy, history of art, geography, chronology, metric, etc.

The Heyne Library of Germanics.—The entire library of Professor Moritz Heyne of the University of Göttingen was bought in 1909. It contains about 5,200 volumes. The collection is rich in the general field of German phil-

ology and especially in lexicography. It has many rare first editions of works of German literature from the sixteenth, seventeenth and eighteenth centuries and has sets of a number of rare priodicals. It is also rich in works upon the history of German civilization.

The Gröber Library in Romance Languages.—The University has recently purchased the library of Professor Gröber of the University of Strassburg. This library contains about 6,500 titles, and, added to what is already in the University library, furnishes somewhat over 10,000 volumes for this field.

The Vahlen Library, the property of the late Johannes Vahlen, Professor of Classical Philology at the University of Berlin, contains about 10,00c volumes and is in itself an excellent working library in classical philological literature. Being especially well supplied with texts of Greek and Latin authors, it supplements most effectively the Dittenberger collection, purchased by the University, which is especially strong in Greek. The addition of this interesting collection to the already good classical library of the University gives this institution one of the best libraries in this field of research in the country.

The Aron Library, collected by the late teacher and student of pedagogy, R. Aron, contains about 20,000 volumes. It is a most scholarly collection of educational documents, among them many exceedingly valuable original and early editions, and furnishes exhaustive firsthand material for the study of the educational movements in Europe, especially in Germany, from the time of Luther and Comenius to the present. The collection of German "Fibeln" or school readers, is unique, and the exhaustive material for the history of juvenile songs and literature, the large set of 17th and 18th century atlases, the collection of rare hymn books and juvenilia make the Aron library in the School of Education a worthy addition to the library of the University.

Furthermore, notable additions have been made in the past few years to the libraries of the departments of history, education, economics, English, and political science.

FEES AND EXPENSES

Except as noted below, graduate students pay fees as follows:

Matriculation fee	$10.00
Incidental fee, each semester	12.00
Diploma fee	5.00

All graduate students who have not matriculated as undergraduates at the University of Illinois pay the matriculation fee on entrance.

All graduate students pay the diploma fee on being recommended for their degrees.

No tuition or incidental fee is charged for graduate courses to scholars, fellows, or members of the corps of instruction or the staffs of the scientific bureaus or experiment stations, nor for undergraduate courses on their study lists if approved by the heads of the departments and by the Dean of the School as necessary or desirable for the proper completion of the work for the degree. Otherwise, graduate students who take undergraduate courses must pay the proper undergraduate fee.

Each student working in laboratories, or in the drafting or engineering classes, is required to make a deposit of from 50 cents to $10.00, to pay for chemicals and apparatus used, and for any breakage or damages. But no charges or deposits for laboratory materials are required from scholars, fellows, or members of the corps of instruction or scientific staffs mentioned above.

Table board may be obtained at prices ranging from $4.00 per week.

Room rent, with two in a room, from $2.50 per week.

THE GRADUATE CLUB

The Graduate Club is an unofficial organization of the graduate students and graduate faculty. Its purpose is to furnish an opportunity for those working in different departments to become acquainted with one another and thus counteract the tendency toward narrowness which intense specialization may sometimes induce.

DEPARTMENTS OF INSTRUCTION

Courses are offered in the following groups of subjects:

A. Language and Literature.
B. History and the Social Sciences.
C. Education, Philosophy and Psychology.
D. The Sciences, including Mathematics.
E. Engineering.
F. Agriculture.

A. Language and Literature

THE CLASSICS

The Degree of Master of Arts in Classics.—The major may be either Latin or Greek, but every candidate for a degree should take work in both languages.

Before the period of the regular course examinations of the second semester, each candidate must also pass two examinations which are to be regarded as tests of attainment rather than as a requirement of special or additional preparation. The first examination consists of written translation at sight, from the candidate's major language, of passages equivalent in difficulty to the translation work of first-year graduate courses. The second examination is oral and designed to show the candidate's general ability and his advancement in the various fields of classical philology, especially those treated in the Classical Proseminar.

The Degree of Doctor of Philosophy in Classics.—The degree is given in classical philology. Major work may be taken in either Latin or Greek, but whichever language is taken as the major, the other must be taken as the first minor.

Greek

Preparation for first-year graduate work in Greek must include at least two years of college Greek in addition to entrance requirements, and three years of college Latin. A reading knowledge of French or German, preferably the latter, is highly desirable for candidates in this subject. The study of history and philosophy is especially recommended.

Courses for Graduates

104. HOMER AND THE HOMERIC QUESTION.—Lectures and readings in alternate hours. The whole of the *Iliad* and a large portion of the *Odyssey* will be read. *Twice a week; both semesters. One unit.*

Associate Professor OLDFATHER.

[Alternates with 105.]

105. PLATO AND ARISTOTLE.— Lectures and readings in alternate hours. Selections from the *Republic* of Plato and the *Ethics* of Aristotle. *Twice a week; both semesters. One unit.* Associate Professor OLDFATHER.

[Alternates with 104. Not given in 1914-15.]

106. GREEK DRAMA.—One play of each of the great dramatists will be made the basis of a detailed investigation into the origin and development of dramatic technique, and the history of that phase of Greek literature. In addition to the plays read in class, certain others will be assigned for private reading. *Twice a week; both semesters. One unit.* Professor MOSS.

[Not given in 1914-15.]

107. GREEK ORATORY.—One or more speeches of each of several orators will be read rapidly, and the remainder of the year will be spent on more detailed study of one or two authors, with especial attention to their style and their relation to their times. Certain problems in the Athenian constitution and legal practice will be assigned for individual study and report. *Twice a week; both semesters. One unit.* Professor MOSS.

LATIN

Preparation for first year graduate work in Latin must include at least three years of college Latin in addition to entrance requirements. A reading knowledge of French or German, preferably the latter, is highly desirable for graduate work in this subject. Some acquaintance with Greek is indispensable for advanced work in Latin. The study of history and philosophy is especially recommended.

Courses for Graduates

102. ROMAN ORATORY.—A study of the subject in its development as a department of literature, with special ref-

erence to the Ciceronian period. *Twice a week; second semester. One unit.* Assistant Professor CANTER.

[Alternates with 112. Not given in 1914-15.]

103. CICERO.—The *De Natura Deorum* and the *De Divinatione.* The Epicurean, Stoic, and Academic theories of religion and their relation to the popular worship will be considered. *Twice a week; first semester. One unit.*

Associate Professor PEASE.

104. LATIN PALAEOGRAPHY.—Lectures on the material and form of ancient books, the methods of copying, and the common errors in manuscripts. A study of facsimiles of codices of different periods and styles, and practice in the principles of text criticism so far as they are dependent upon palaeography. *Twice a week; first semester. One half to one unit.* Associate Professor PEASE.

105. A SURVEY OF LATIN POETRY.—Lectures on the history and development of Latin poetry. Typical selections from the principal authors and periods treated will be assigned for outside reading and portions will be interpreted in class. *Twice a week; second semester. One unit.*

Associate Professor PEASE.

[Not given in 1914-15.]

106. TERENCE.—The comedies of Terence will be read entire and two or three plays interpreted in class. Lectures on literary history and the syntax of early Latin. *Twice a week; first semester. One unit.*

Associate Professor OLDFATHER.

[Alternates with 113. Not given in 1914-15.]

107. LATIN EPIGRAPHY.—The purpose of this course is to familiarize the student with the forms and language of inscriptions and to read selections from these in the Corpus Inscriptionum Latinarum, especially of such as are important for their content. A short report may be called for. *Twice a week; second semester. One-half to one unit.*

Associate Professor PEASE.

108. TACITUS.—The Histories. Some attention will be given to the style of Tacitus but particular emphasis will be placed upon political and social conditions. *Twice a week; second semester. One unit.* Professor BARTON.

109. VIRGIL.—The life and works of Virgil, with study of his sources and of his influence upon later literature. *Twice a week; second semester. One unit.*

Associate Professor PEASE.

112. ROMAN HISTORIOGRAPHY.—Ultimate and documentary sources of Roman history, with a consideration of the aims, methods and general character of historical composition as shown by selections read from its chief representatives at Rome. *Twice a week; second semester. One unit.* Assistant Professor CANTER.

[Alternates with 102.]

113. PLAUTUS.—Six comedies of Plautus will be read and two or three interpreted in class. Lectures on literary history and text tradition of Plautus. *Twice a week; first semester. One unit.* Associate Professor OLDFATHER.

[Alternates with 106.]

114. CAESAR.—A study of the historical works, especially the *Bellum Gallicum,* in their literary and historical setting. *Twice a week; second semester. One unit.*

Associate Professor OLDFATHER.

Courses for Graduates and Advanced Undergraduates

7. SATIRE.—Selected *Satires* and *Epistles* of Horace and selected *Satires* of Juvenal, with lectures introductory to the subject. *Three times a week; first semester. Half unit.* Associate Professor PEASE.

14. SENECA.—Selections from his letters and tragedies. A considerable portion of the letters will be read in class, while others will be assigned for outside reading and class interpretation. Two of the tragedies will be read and interpreted. *Three times a week; second semester. Half unit.* Professor BARTON.

22. LATE LATIN.—Rapid reading of selections from Latin writers from Minucius Felix to Cassiodorus. This course will be of value to students of the history of the period and to those interested in the earlier patristic literature. It is open to seniors and graduates who have had two years of college Latin or who otherwise satisfy the instructor of their ability to do the work required. *Twice a week; second semester. Half unit.*

Associate Professor PEASE.

Classical Philology

110. Proseminar.—This course is designed to make clear the aims and methods of Classical Philology, to outline the more important divisions of the subject, and to present the main sources of bibliographical material together with selected bibliographies of certain fields. Attention is given to the preparation of theses for advanced degrees.

All graduate students who are taking Latin or Greek as a major for the master's degree must take this course unless they have already completed it or its equivalent. *Once a week; both semesters. Quarter unit.*

Associate Professors Oldfather and Pease, assisted by the other members of the department.

101. Principles of Comparative Grammar.—A general survey of the principles of linguistic science is followed by a systematic study of Greek and Latin sounds and inflections. Attention is also given to the historical development of Latin syntax. *Three times a week; first semester. One unit.* Assistant Professor Canter.

[Not given in 1914-15.]

ENGLISH

Students who enter upon graduate work with English as their major subject are required to give evidence of ability to write well, and of a considerable acquaintance with English literature. They should have had training as undergraduates in the classics, the modern languages, history, and philosophy.

A reading knowledge of French and German is from the beginning highly desirable; after the first year it is indispensable.

The Degree of Master of Arts in English.—In addition to complying with the general rules of the Graduate School, candidates for the degree of Master of Arts in English must comply with the following rules of the Department of English: (1) they must choose a portion of their work from the group of courses described as "for graduates;" (2) must offer an elementary course in Anglo-Saxon; and (3) must take, besides the regular semester examinations in all their courses, a general examination, oral or written as the

department may prescribe, which shall be a final test of the candidate's fitness and ability.

The Degree of Doctor of Philosophy in English.—Candidates for the degree of Doctor of Philosophy in English may expect to be examined on the entire field of the English language and literature. They are urged, furthermore, to acquaint themselves as fully as possible with the history and the philosophy of the period in which their main interest lies, and with the foreign language and literature most closely related to English in that period.

Courses for Graduates

101. RESEARCH IN SPECIAL PERIODS.—Competent graduate students are encouraged to seek the advice and assistance of the Department of English and to submit to the Department plans for study in the language or literature of the periods mentioned below.

A. Anglo-Saxon Language and Literature.
Professor DODGE and DR. ZEITLIN.

B. Thirteenth and Fourteenth Centuries.
Assistant Professor JONES.

C. Sixteenth Century.
Professor ALDEN and Professor DODGE.

D. Seventeenth Century.
Professor ALDEN, Assistant Professor BALDWIN.

E. Eighteenth Century.
Professor SHERMAN, Assistant Professor PAUL.

F. Nineteenth Century.
Professor SHERMAN, Associate Professor FULTON.

102. SEMINAR IN COMPARATIVE LITERATURE.—Subject: The Theory and Practice of Tragedy in the Renaissance. *Twice a week; first semester. One unit.*
Professor ALDEN.

106. ENGLISH LITERARY CRITICISM. *Twice a week; both semesters. One unit.* Associate Professor FULTON.
[Not given in 1914-15.]

107. SHAKESPEARE: an introduction to textual and interpretative criticism through the detailed study of a selected play. *Twice a week; second semester. One unit.*
Professor ALDEN.

108. The English Epic in the Sixteenth, Seventeenth, and Eighteenth Centuries from the Point of View of Classical Theory. *Twice a week; both semesters. One unit.* Associate Professor Fulton.

109. German and Scandinavian Influences on English Literature of the Eighteenth and Nineteenth Centuries. *Twice a week; first semester. One unit.* Professor Dodge.

110. Old English (Anglo-Saxon) Poetry. *Twice a week; first semester. One unit.* Professor Dodge.

113. Historical Prose Syntax.—The forces, native and foreign, at work in the development of English prose style as far as it relates to sentence structure. *Twice a week; both semesters. One unit.* Dr. Zeitlin.

126. Ballads and Metrical Romances. *Twice a week; both semesters. One unit.* Assistant Professor Jones.

127. Middle English.—Critical reading of Middle English texts. Assistant Professor Jones.

[Not given in 1914-15.]

135. Problems in American Literature. *Twice a week; both semesters. One unit.* Assistant Professor Paul.

136. The Transition from the Seventeenth to the Eighteenth Century: the Rise of Classicism. Assistant Professor Paul.

[Not given in 1914-15.]

137. Prose Writers of the Nineteenth Century.—Studies in the relation of literature to social forces, with special attention to the works of Mill, Carlyle, Newman, Ruskin, Arnold, and Pater. *Twice a week; both semesters. One unit.* Professor Sherman.

138. The Romantic Movement in England. Professor Sherman.

[Not given in 1914-15.]

150. Old Irish.—Selections from the Táin bó Cúalnge and the romances; lectures on Old and Middle Irish literature. *Twice a week; first semester. One unit.* Dr. Schoepperle.

Courses for Graduates and Advanced Undergraduates

A. Literature and Language

3. The Poetry of Milton.—Origins, forms, artistic and ethical values; Milton's place in English literary history. *Twice a week; second semester.*

Professor Baldwin.

4. English Versification.—Theory of English rhythm and metre; history of the development of the forms of English verse. *Three times a week; first semester.* Professor Alden.

5. Shakespeare.—Intensive study of a few plays, with special emphasis on *Hamlet*. *Three times a week; second semester.* Professor Dodge.

7. Chaucer and his Contemporaries. (The first semester, devoted wholly to Chaucer, may be taken separately.) *Three times a week; both semesters.*

Assistant Professor Jones.

8. Old English (Anglo-Saxon).—Grammar; prose; short poems; *Beowulf*. (The first semester may be taken separately.) *Three times a week; both semesters.*

Professor Dodge.

14. Studies in the History of Journalism. *Twice a week; both semesters.* Assistant Professor Scott.

15. Teachers' Course.—Methods of teaching English literature and composition in the high school. (Either semester may be taken separately. This course, while open to graduate students, is not credited toward advanced degrees.) *Twice a week; both semesters.*

Assistant Professor Paul.

18. Modern English Grammar.—The structure of the sentence and its analysis into the parts of speech; the common grammatical categories; the peculiarities of English syntax. *Three times a week; second semester.*

Dr. Zeitlin.

35. English Drama (exclusive of Shakespeare).—A. (first semester), From the beginning to 1600; B. (second semester), From 1660 to 1700. (Either semester may be taken separately.) *Three times a week; both semesters.* Professor Dodge, Professor Sherman.

38. The Arthurian Tradition in England.—Primitive elements; the historical Arthur; Celtic, French, and Italian influences; the tradition in England from the early romances to Arnold. *Three times a week; second semester.* Dr. Schoepperle.

39. Introduction to the Literature of the Middle Ages.—The relations of English and continental literature, to the fourteenth century. *Three times a week; first semester.* Dr. Creek.

45. The Development of the Modern Drama.—Dramatic tendencies in the Eighteenth and Nineteenth centuries, both in England and on the Continent; representative readings, and lectures from the standpoint of comparative literature. *Twice a week; both semesters.* Mr. Guild and others.

B. Rhetoric

15. Advanced Newspaper Writing.—The larger problems in reporting; application of principles of history, economics, and political science to current public events; editing; editorial writing. *Three times a week; both semesters.* Assistant Professor Scott.

17. Advanced Composition.—Practice writing, with special emphasis on the study of structure; criticism of current periodical literature; the development of material for reports, magazine articles, etc. (Open to a limited number of students, and only on recommendation.) *Three times a week; second semester.* Mr. Guild.

GERMANIC LANGUAGES

German

Students desiring to take German as a major are required to have finished successfully a four years' course of undergraduate work in German, corresponding to the four years' course in German at this University. They are expected to be familiar with the principal works of the writers of the classical and modern periods of German literature, to show a general knowledge of the history of German literature and to be able to follow lectures in the German language.

Of collateral subjects, a reading knowledge of Latin and French is required. It is desirable that candidates for the degree of Ph.D. have some knowledge of Greek. All students are expected to have had a course in German history.

Courses for Graduates

101. SEMINAR IN GERMANIC PHILOLOGY.—The work is adapted to the abilities and tendencies of the students. The primary object is to give training in original research. The result of the work, when of value, may be published in the *Journal of English and Germanic Philology. Once a week; both semesters. One unit.* Professor GOEBEL.

103. INTRODUCTION TO THE HISTORICAL STUDY OF THE GERMANIC LANGUAGES.—Lectures: discussion of special topics; History of German Philology. Comparative Grammar of the Old Germanic dialects. *Twice a week; second semester. One unit.* Professor GOEBEL.

104. GOTHIC.—An introductory study of its grammar and literature. *Twice a week; first semester. One unit.* Professor GOEBEL.

105. OLD HIGH GERMAN.—Grammar and interpretation of the oldest literary documents. *Three times a week; second semester. One unit.* Dr. BLOOMFIELD.

109. GOETHE'S AND SCHILLER'S PHILOSOPHY. *Twice a week; both semesters. One unit.* Professor GOEBEL.

110. EARLY GERMAN DRAMA.—The development of the German drama up to the Reformation, including the medieval religious drama, the Shrovetide plays and the beginnings of the Humanistic drama. *Twice a week; first semester. One unit.* Assistant Professor BROOKS.

113. GERMAN LITERATURE OF THE FIFTEENTH AND SIXTEENTH CENTURIES.—Survey of the literature on the background of the general history of the time. Luther and the Reformation, Mastersingers and Folksong, the Reformation drama. Hans Sachs, Brant, Fischart, the chap books, the English comedians. *Twice a week; second semester. One unit.* Assistant Professor BROOKS.

115. HISTORY OF GERMAN LITERATURE FROM GOETHE'S DEATH TO THE PRESENT TIME. *Twice a week; both semesters. One unit.* Associate Professor LESSING.

116. Medieval German Literature with Reference to Political, Religious, and Social History.—Research course. *Twice a week; both semesters. One unit.*
Associate Professor Lessing.

[Not given in 1914-15.]

117. History of German Literature During the Eighteenth Century. *Twice a week; both semesters. One unit.*
Professor Goebel.

118. The German Drama Since Schiller.—Research course. *Twice a week; both semesters. One unit.*
Associate Professor Lessing.

119. The German Novel.—Research course. *Twice a week; both semesters. One unit.*
Associate Professor Lessing.

[Not given in 1914-15.]

121. Walther von der Vogelweide.—Lectures and interpretations. *Twice a week; second semester. One unit.*
Professor Goebel.

124. History of the Drama. The beginnings of the drama and its development in the eighteenth century. *Twice a week; first semester. One unit.*
Assistant Professor Meyer.

[Not given in 1914-15.]

Courses for Graduates and Advanced Undergraduates

8. Schiller.—The life of Schiller; *Wallenstein* and other selections. *Three times a week; first semester.*
Associate Professor Lessing.

[Not given in 1914-15.]

9a. Goethe's Faust.—The Faust legend and early Faust books and plays; the genesis of Goethe's *Faust;* reading of both parts. *Twice a week; both semesters.*
Professor Goebel.

[Not given in 1914-15.]

9b. Goethe-Schiller.—Interpretation of Goethe's poems. Goethe's *Tasso* and Schiller's *Ueber naive und sentimentalische Dichtung. Twice a week; both semesters.*
Professor Goebel.

11. German Literature after the Reformation.—Lectures; recitations; reports on assigned reading. *Three times a week; second semester.*

Associate Professor Lessing.

25. Teacher's Course.—Discussion of methods; examination of text-books. *Twice a week; second semester.*

Assistant Professor Brooks.

26. German Literature before the Reformation.—Lectures; recitations; reports on assigned reading. *Three times a week; first semester.*

Associate Professor Lessing.

27. Lessing.—The life of Lessing; *Nathan der Weise, Emilia Gallotti* and other selections. *Three times a week; second semester.* Associate Professor Lessing.

29. Advanced Prose Composition.—Themes on Germany and German life, based on suitable reading, discussed in German. *Three times a week; both semesters.*

Dr. Koller.

31. Middle High German.—Grammar and readings. *Twice a week; first semester.* Professor Goebel.

The Scandinavian Languages

Preparation for graduate work in the Scandinavian languages or literature must include a reading knowledge of one of the Scandinavian languages and systematic work in the undergraduate courses in Scandinavian or their equivalent. Any graduate student in language may, however, be admitted to the purely philological courses.

Courses for Graduates

101. Old Norse.—Introduction to the language as a member of the Germanic group. Reading of the *Prose Edda* with selections from the King's Sagas. *Twice a week; both semesters. One unit.*

Associate Professor Flom.

102. Old Danish.—Introduction to the study of the language with readings from the oldest literature. *Twice a week; first semester. One unit.*

Associate Professor Flom.

[Not given in 1914-15.]

103. Old Swedish.—Introduction to the study of the language with readings from the oldest literature. Lectures on comparative Scandinavian grammar. *Twice a week; second semester. One unit.*

Associate Professor Flom.

[Not given in 1914-15.]

110. Advanced Old Norse.—Critical study of all the lays of the *Elder Edda. Twice a week; both semesters. One unit.* Associate Professor Flom.

Prerequisite: Course 101 or the equivalent.

130. The Runic Inscriptions.—Lectures on the origin and the history of the runes. Interpretation of Germanic and Scandinavian inscriptions; Germanic grammar. *Twice a week; second semester. One unit.*

Associate Professor Flom.

Prerequisite: Old Norse or one other Old Germanic dialect.

[Not given in 1914-15.]

140. Early Scandinavian Paleography.—Lectures and practical work with the oldest manuscripts. *Twice a week; second semester. One unit.*

Associate Professor Flom.

Prerequisite: Old Norse.

[Not given in 1914-15.]

150. Research.—Special problems in Scandinavian philology or literature. *First semester.* The unit value may vary. Associate Professor Flom.

Courses for Graduates and Advanced Undergraduates

11. Outline History of the Swedish Language and Literature. *Twice a week; first semester.*

Associate Professor Flom.

Prerequisite: A good knowledge of Swedish.

14. History of Old Norse Literature.—Lectures. *Twice a week; first semester.* Associate Professor Flom.

16. Survey of Early Scandinavian Culture.—Discussion of the stone, bronze, and the iron ages in the North. *Twice a week; second semester.*

Associate Professor Flom.

ROMANCE LANGUAGES

Before entering upon the study of Romance languages for an advanced degree, the candidate must have had a total of at least thirty hours of college work in these languages. Eighteen of these hours must be in one of these three languages, French, Italian, or Spanish, but no candidate will be received who has not had at least twelve hours in French. In addition a candidate must have had good training in Latin, and be able to read ordinary German prose.

FRENCH

Courses for Graduates

101. OLD FRENCH EPIC LITERATURE.—Critical reading and interpretation of the greater national and courtly epics. Collateral study of the history of these types of medieval literature. For such students as prefer it, the collateral work may consist of the elements of Old French historical grammar. *Twice a week; both semesters. One unit.* Professor OLIVER.

[Not given in 1914-15.]

102. OLD FRENCH LYRIC AND PROSE LITERATURE.—Critical interpretation of the earlier Old French dramatists, didactic, chronicle and lyric writers. Collateral study of the history of these types of medieval literature. For such students as prefer it, the collateral work may consist of the elements of Old French historical grammar. *Twice a week; both semesters. One unit.* Professor OLIVER.

103. SEVENTEENTH CENTURY PROSE WRITERS.—Lectures on French culture, society and prose literature of the seventeenth century. The great preachers and moralists. Jansenism and Port Royal. The formation of the classic ideals. Collateral readings of the greater masterpieces, with assigned problems for special investigation. *Once a week; both semesters. Half unit.* Professor OLIVER.

104. EIGHTEENTH CENTURY PROSE WRITERS.—Lectures on the society, culture and prose literature of the eighteenth century. The attack upon the classic ideals. Growth of the revolutionary spirit. First movements towards romanticism. Readings from the greater master-

pieces with collateral study of special problems. *Once a week; both semesters. Half unit.* Professor OLIVER.

[Not given in 1914-15.]

105. THE FIFTEENTH AND SIXTEENTH CENTURIES IN FRANCE.—A study of the non-dramatic literature of the period. *Twice a week; both semesters. One unit.*

Associate Professor CARNAHAN.

[Not given in 1914-15.]

106. EARLY FRENCH DRAMA.—A study of the origins of the drama in France, and its development up to the Renaissance. *Twice a week; both semesters. One unit.*

Associate Professor CARNAHAN.

110. INTRODUCTION TO ROMANCE PHILOLOGY.—Historical Phonology and Morphology of the Romance languages. Special emphasis is placed upon the linguistic problems which confront the teacher of French, Italian and Spanish. *Twice a week; both semesters. One unit.*

Assistant Professor FITZ-GERALD.

[Not given in 1914-15.]

111. VULGAR LATIN AND MEDIEVAL LATIN.—History of the Latin language and literature from the earliest times to the Carolingian epoch. Introduction to medieval paleography and training in paleographical research. *Twice a week; first semester. One unit.*

112. HISTORY OF FRENCH LITERATURE IN THE MIDDLE AGES, FROM THE CAROLINGIAN EPOCH TO GUILLAUME DE MACHAULT.—A synthetical study of Old French literature as a part of the contemporary general culture. The relation between the literary documents and the various branches of the fine arts. Reading of texts. Theses on problems concerning the civilization of the Middle Ages. *Twice a week; second semester. One unit.*

113. INTRODUCTION TO THE HISTORICAL STUDY OF THE ROMANCE LANGUAGES, ESPECIALLY OF OLD PROVENCAL.—General linguistics. Old Provencal phonology, morphology, syntax, and paleography. *Twice a week; first semester. One unit.*

[Not given in 1914-15.]

114. THE PRINCIPLES OF ROMANCE VERSIFICATION.—Origin of Old Provencal, Old French, Italian and Spanish

verse from Medieval Latin poetry. Rhythmical analyses of such poems with special consideration of their musical character. *Once a week; second semester. Half unit.*

116. History of Old Provencal Literature.—Its origin and its influence on the other Romance literatures. The art of the Troubadours. Critical interpretation of the texts from photographic reproductions and from printed materials with a view to preparing critical editions of such texts. *Twice a week; second semester. One unit.*

[Not given in 1914-15.]

118. Germanic Elements in the Romance Languages and Literatures.—Linguistic influences, phonetics and vocabulary. Comparative study of the interrelations of Romance and Germanic literatures during the Middle Ages, with special emphasis upon the respective cultural conditions. *Once a week; second semester. Half unit.*

[Not given in 1914-15.]

119. Old French Phonology and Morphology.—Development of Old French from Vulgar Latin. *Twice a week; both semesters. One unit.*

Assistant Professor Blondheim.

125. Seminar.—Research work in preparation for theses in the field of the Romance languages. *Twice a week; both semesters. One unit.*

The Various Members of the Department.

Courses for Graduates and Advanced Undergraduates

10. General Survey of French Literature.—An introduction to more extended study of special periods and authors. The main currents of French literature from the beginning to the present time. *Three times a week; both semesters.* Associate Professor Carnahan.

21. History of French Poetry.—A study of the main principles and declamation and interpretation of French poetry from the Trouvères to the present time. Recitations and prosodical analyses of the different categories of such poems. The musical treatment of French verse. Racine's influence upon the evolution of the French opera. Rousseau and the melodrama. Rhythmical tendency of the modern libretto. This course is conducted in French. *Three times a week; first semester.*

23. Modern French Poetry from Rousseau to the Present Time.—Biographical study of the most important French poets. Romanticists, Parnassiens and Verslibristes. Comparative study of French and Germanic poetry during the same period. Introduction to original research in modern French literature. This course is conducted in French. *Three times a week; second semester.*

24. The Drama of the Seventeenth and Eighteenth Centuries.—Corneille, Racine, Molière, Voltaire, Marivaux, Sedaine, Beaumarchais. Lectures and interpretation of the greatest plays of these and other masters. *Twice a week; both semesters.* Professor Oliver.

26. French Literary Criticism.—After an introduction treating of the history of criticism in antiquity and in the Italian Renaissance, the work of the principal French critics is studied. Special emphasis is laid upon the seventeenth and the nineteenth centuries, in connection with the development of classicism and romanticism. *Twice a week; both semesters.* Assistant Professor Blondheim.

Spanish

Courses for Graduates

131. Oldest Monuments of the Spanish Language; Origins of Spanish Poetry.—Historical grammar and palæography; critical interpretation of texts. *Twice a week; both semesters. One unit.*

Assistant Professor Fitz-Gerald.

132. The Novela of the Golden Age.—A study of the political and social conditions in Spain from 1560 to 1700 is followed by an examination of the various kinds of prose fiction produced in this period, with special attention to *Don Quixote* and the *Novelas Exemplares* of Cervantes. *Twice a week; both semesters. One unit.*

Assistant Professor Fitz-Gerald.

[Not given in 1914-15.]

133. Origins of the Spanish Novela and of the Comedia.—In lectures and readings the development of Spanish prose fiction and of Spanish dramatic art will be studied for the period previous to the Golden Age. *Twice a week; both semesters. One unit.*

Assistant Professor Fitz-Gerald.

134. The Spanish Ballad.—Lectures on the development of the various types of the ballad in Spain. Extensive collateral reading with reports. *Twice a week; both semesters. One unit.* Dr. Seymour.

135. The Modern Novel in Spain.—Lectures on the development of the modern novel in Spain from the middle of the nineteenth century up to the present time. Critical appreciation of leading masterpieces. Extensive collateral reading. Comparative study of the development of the novel in Spain, France and Italy. *Twice a week; both semesters. One unit.* Dr. Seymour.

[Not given in 1914-15.]

Courses for Graduates and Advanced Undergraduates

11. The Spanish Drama of the Sixteenth and Seventeenth Centuries.—The principal dramatists of the classical period will be studied, especially Lope de Vega, Calderón, Tirso de Mólina, and Ruiz de Alarcón. *Twice a week; both semesters.* Dr. Seymour.

15. General Survey of Spanish Literature.—An introduction to more extended study of special periods and authors. *Twice a week; second semester.* Dr. Seymour.

Italian

Course for Graduates and Advanced Undergraduates

2. Literary Course.—First semester: Rapid reading from the works of the principal Italian writers of the nineteenth century. Second semester: Introduction to the works of Dante, Petrarch and Boccaccio with selected readings. *Twice a week; both semesters.* Dr. Moore.

B. History and the Social Sciences

ECONOMICS

Every student entering upon graduate work in economics must have had a course in the principles of the science and also in some special part of the field, such as public finance or money and banking. The work should represent about eight semester hours.

Graduate students who are making economics their major are required during their first year to acquaint them-

selves with the works of the masters in the science, either by taking course 101 or by private reading for examination. In the second or third year they are expected to elect courses 105 and 120, and some fundamental course in political science and sociology (either course 11 or 102 in sociology, and political science 101 and 102) unless they have already had such courses. Candidates for the master's degree are examined on the whole year's work, late in May or early in June.

Complete sets of all the important French, German, Italian, English, and American economic and financial journals are in the library, as well as a number in other languages; more than ninety periodicals, foreign and domestic, in economics, finance, commerce, industry, statistics, etc., are currently received. The library is unusually strong in railroad literature, economic history, labor, finance and general theory.

Courses for Graduates

101. Economic Theory.—This is a survey of the field of general economic theory, with emphasis on theories of distribution and their relation to the ethical, philosophical and political views of this and other periods. The course must be taken in the first year of graduate work by all students who have not had its equivalent. *Twice a week; both semesters. One unit.* Professor Kinley.

103. Railway Administration.—Topics relating to current railway management are assigned for investigation. report and discussion. The course is primarily intended for candidates for the degree of A. M. in Railway Administration. *Once a week; both semesters. Half unit.*
Professor Dewsnup.

104. Foreign and Colonial Trade of the United States.—A detailed study of the foreign commerce of the United States based upon the use of governmental publications. *Twice a week; second semester. One unit.*
Assistant Professor Litman.

105. Public Finance.—The history and theory of public revenue and expenditure. *Twice a week; both semesters. One unit.* Professor Bogart.

106. Railway Policy.—A. History of railway development in the United States. B. History of railway development in foreign countries, particularly in western Europe. C. The State and the Railway. The cycle of topics requires three years for the completion of the course. The topic in 1914-1915 is B. *Once a week; both semesters. Half unit.*
Professor Dewsnup.

107. The Corporation in Economic Evolution. *Once a week; both semesters. Quarter unit.*
Professor Robinson.

[Not given in 1914-15.]

109. Theory of Industrial Consolidations.—The nature of industrial consolidations; the conditions and causes responsible for their development and their effects upon the production and distribution of wealth. *Once a week; both semesters. Quarter unit.* Professor Robinson.

118. Seminar.—The Seminar meets weekly for the discussion of the results of students' investigation, etc.
Members of the Staff.

120. History of Economic Thought. *Twice a week; first semester. One unit.* Dr. Thompson.

122. Advanced Economic History of the United States. *Twice a week; both semesters. One unit.*
Professor Bogart.

[Not given in 1914-15.]

Theory of Statistics. See Mathematics 129.

Courses for Graduates and Advanced Undergraduates

4a. Financial History of the United States to the Civil War.—A study of colonial and federal finance, including currency, banking, tariff and fiscal questions. *Twice a week; second semester.* Assistant Professor Weston.

[Not given in 1914-15.]

4b. Financial History of the United States since 1860.—A study of the finances of the Civil War and reconstruction period, and of the recent development of both public and private finance, with special reference to business conditions. *Twice a week; second semester.*
Assistant Professor Weston.

5. Public Finance.—Public debts, revenue, taxation, etc. *Three times a week; first semester.*
Professor Bogart.

8. The Money Market.—An advanced study of dealings in money, credit, foreign exchange, crises, etc. *Twice a week; second semester.* Assistant Professor Weston.

10. Corporation Management and Finance. *Three times a week; first semester.* Professor Robinson.

11. Industrial Consolidation.—The development of industrial consolidations; plans for controlling trusts, etc. *Three times a week; second semester.*
Professor Robinson.

12. Labor Problems. *Three times a week; first semester.* Professor Kinley.

13. Economic Development of Europe Since the Industrial Revolution. *Three times a week; second semester.* Professor Bogart.

17. Economic History of Agriculture.—General characteristics of agriculture, and its development as an industry in various countries at various times. State of the agricultural class. Relation of agriculture to other industries. Relation of the state to agriculture. *Twice a week; second semester.* Dr. Thompson.

21. Socialism and Economic Reform. *Three times a week; second semester.* Professor Kinley.

29. Foreign Commerce and Commercial Politics.—A study of the various commercial systems, mercantile, free trade and protective, etc. *Three times a week; first semester.* Assistant Professor Litman.

30. Tariff and Customs Regulations of the United States. *Three times a week; second semester.*
Assistant Professor Litman.

41. Railway Transportation.—A study of the more general aspects of railway transportation in the United States, with reference to conditions abroad. *Three times a week; first semester.* Professor Dewsnup.

42. Railway Rates, their Construction and Regulation.—A somewhat detailed study of the rate structure of the United States, followed by a discussion of rate theory

and the policy of the Interstate Commerce Commission. *Three times a week; second semester.* Professor DEWSNUP.

43. THE THEORY AND PRACTICE OF RAILWAY ADMINISTRATION.—A description of the organization and methods of traffic management and a discussion of the problems connected therewith. *Twice a week; both semesters.*
Professor DEWSNUP.

45. RAILWAY OPERATION.—A study of the organization, methods of management, and associated problems of the operating department of the railroad. *Twice a week; both semesters.* Professor DEWSNUP.

HISTORY

A student entering upon graduate work must have had at least the equivalent of the introductory college courses in European and American history, corresponding roughly to History 1 and 3. All historical students should have a reading knowledge of German and French; for medieval history some knowledge of Latin is indispensable, and in certain fields of American history Spanish is needed.

Advanced courses in history at the University of Illinois are of three kinds: (1) Instruction in methodology, historiography, and bibliography. This work (in course 103) is required of all graduate students in history during their first year. (2) Seminary courses for the study of special fields with a view primarily to training in the methods of historical criticism and research. (3) Courses for information and guidance in general reading. Opportunities for research are offered in the following fields: Medieval history; English history with emphasis upon medieval institutions; modern European history; American history with special reference to institutions, colonial society, western development, and the period of sectional conflict, 1840-65; the history of Latin America.

ILLINOIS SURVEY.—Historical students have an opportunity to pursue research in western history in connection with the Illinois Survey, which is an organization for the purpose of carrying on systematic studies in the history of Illinois.

Attention is also called to the fact that the University of Illinois has for some time co-operated with the Illinois

State Historical Society and the trustees of the State Historical library, in the gathering and editing of archive material. As a result of this relation instructors and graduate students in the department have contributed from time to time to the publications of these state organizations and have been given useful training in the study of manuscript as well as printed material.

The Historical Club, consisting of graduate students in the department, meets twice a month. The program is devoted to reviews of recent progress in historical work and to reports of investigations.

HIGHER DEGREES IN HISTORY

The following statement regarding the specific requirements for higher degrees in History is subject to the general requirements of the Graduate School as set forth on pages 12 to 18.

Master of Arts

In addition to meeting the general tests in the specific courses taken, each candidate is expected to pass a general oral examination, and written examinations in any two fields selected from the following: Ancient History; Medieval History of Continental Europe; Modern History of Continental Europe; English History; American History. Candidates for this degree are expected to have a general knowledge of historical bibliography and methodology (see course 103).

Doctor of Philosophy

Major Requirements.—In view of the broad scope of historical studies and in order to secure greater thoroughness, a candidate who selects history as his major subject may for the present offer himself for examination in any four of the fields indicated below, stating also the particular field among these four in which he wishes to specialize and in which his thesis is to be written:

1. Ancient history (with special reference to Greece and Rome). 2. Medieval history and institutions of Continental Europe, to the close of the thirteenth century. 3. Continental Europe from 1300 to 1648. 4. Continental

Europe and its dependencies since 1648 (except as included in 5 and 6). 5. The History of England and its dependencies (not including America before 1783). 6. American history (except as included in 5, and with primary reference to the United States). This enumeration of fields is not to be regarded as excluding the possibility of accepting others as may be determined by the Department in individual cases.

MINOR SUBJECTS.—A candidate for the doctorate in history may select as his first minor one of the divisions of the field of history listed above which is not offered as a part of his major. He should preferably, however, select his minors from subjects offered by other departments. The following list of suitable minors is intended to be suggestive rather than exhaustive or compulsory.

I. IN POLITICAL SCIENCE.—(Any two acceptable for a first minor; any one, for a second minor): 1. International law and diplomacy. 2. Modern government. 3. Municipal government. 4. Constitutional and administrative law and jurisprudence. 5. Political theory.

II. IN ECONOMICS AND SOCIOLOGY.—Any two acceptable for a first minor; any one, for a second minor: 1. Economic history. 2. Economic theory. 3. Public and private finance. 4. Social reform. 5. Principles of sociology.

III. IN PHILOSOPHY AND EDUCATION.—(Any two acceptable for a first minor; any one, for a second minor): 1. History of ancient and medieval philosophy. 2. History of modern philosophy. 3. History of education.

IV. IN LITERATURE.—Some division of the history of literature which may be either the comparative literature of a limited period or the literature of a particular country for a more extended period as may be agreed upon in each case.

Courses for Graduates

101. SEMINARY IN AMERICAN HISTORY.—Bibliography; practise in the solution of typical problems; reports on the progress of individual investigations by instructors and students. *Two hours, once a week; both semesters.**

Professor GREENE and others.

*The unit value for graduate students of courses in this department is subject to arrangement on registration.

Students interested in the investigation of particular topics, whether with a view to writing theses or otherwise, may register in this course and will be advised by members of the department as follows:

On American history before 1789 and problems of church and state. Professor GREENE.

On American history after 1789 and Latin-American history. Assistant Professor ROBERTSON, Dr. COLE.

On the history of the West.
Professor ALVORD, Dr. BUCK.

102. STUDIES IN ENGLISH HISTORY.—Selected problems from the history of England in the later middle ages and the early modern period. *Twice a week; both semesters. One unit.* (See statement for 104.)
Professor LARSON.

103. INTRODUCTION TO HISTORICAL CRITICISM.—Selected problems in various fields. Required of all candidates for an advanced degree in history who do not present evidence of similar training elsewhere. *Twice a week; both semesters. Half unit.*
Associate Professor LYBYER and others.

104. RESEARCH IN EUROPEAN HISTORY.—Competent students will be guided in the investigation of topics in medieval and modern history. In connection with History 102 and 104, there will be a fortnightly conference of instructors and graduate students in European history. *Both semesters.* Associate Professor LYBYER and
Assistant Professor DUNCALF.

105. HISTORY OF WESTERN EXPANSION, 1763-1818.—The period indicated is covered by lectures and readings, but the main object of the course is the study of various problems in the interpretation of western history. *Once a week; both semesters. One-half or one unit.*
Professor ALVORD.

111. SPANISH-AMERICAN RELATIONS.—The relations of the Latin-American States with Europe and the United States. An intensive study of such topics as the Monroe Doctrine, the development of international trade, etc. *Once a week; both semesters.* Assistant Professor ROBERTSON.

112. The History of Church and State Relations in America. *Two hours a week; second semester.*
Professor Greene.

[Not given in 1914-15.]

Courses for Graduates and Advanced Undergraduates

4. Constitutional History of England.—During the first semester the emphasis is placed on institutional origins; in the second semester particular attention is given to modern constitutional practise. *Three times a week; both semesters.* Professor Larson.

8. Medieval Culture.—A study of the intellectual development of the middle ages with special reference to England. This course may be combined with History 19 (Medieval Society). *Three times a week; first semester.*
Professor Larson.

9. European Society in the Later Middle Ages and the Period of the Renaissance.—The transition from medieval to modern ideals. This course is an appropriate continuation of Course 19, though either may be taken separately. *Twice a week; second semester.*
Assistant Professor Duncalf.

10. The Development of American Society in the Eighteenth Century.—An introduction to the study of the American Revolution. *Three times a week; second semester.* Professor Greene.

12. History of Germany. *Twice a week; both semesters.*

[Not given in 1914-15.]

14. The Making of the Federal Constitution.—The political, economic, and social conditions from 1783 to 1798 which resulted in the framing and ratification of the federal constitution of 1787; the contemporary arguments for and against the ratification of the constitution. *Twice a week; first semester.* Professor Greene.

15. The Civil War and the Reconstruction. *Three times a week; second semester.* Dr. Cole.

16. The History of the Exploration and Colonization of the West.—First semester: The Mississippi

Valley from the beginning of the Spanish explorations to the close of the War of 1812; second semester: the development of the Mississippi Valley since 1815 and the progress of Westward expansion to the Pacific. By permission of the instructor the second semester may be taken separately. *Twice a week; both semesters.* Professor ALVORD.

19. MEDIEVAL SOCIETY WITH SPECIAL REFERENCE TO CONTINENTAL EUROPE IN THE ELEVENTH AND TWELFTH CENTURIES.—A study of institutions and economic conditions with a view to illustrating the Crusades and other characteristic movements of the period. This course may profitably be combined with History 8 (Medieval Civilization in England). *Twice a week; first semester.*

Assistant Professor DUNCALF.

20. EUROPE FROM THE PERIOD OF THE NAPOLEONIC EMPIRE TO THE PRESENT TIME.—First semester: The Nineteenth Century to the formation of the German Empire in 1871; second semester: Europe since 1871. Either semester may be taken separately. *Three times a week; both semesters.* Associate Professor LYBYER.

21. THE HISTORY OF THE UNITED STATES SINCE THE CIVIL WAR.—Historical introduction to contemporary American politics. *Twice a week; first semester.*

Assistant Professor ROBERTSON.

26. HISTORY OF THE LATIN-AMERICAN COLONIES.—The political, economic, social, and intellectual life of Spain during the period of discovery. The exploration, settlement and civilization of Spanish America and the Philippines. Some attention is also given to the exploration and colonization of Brazil. *Three times a week; first semester.* Assistant Professor ROBERTSON.

27. HISTORY OF LATIN-AMERICA FROM THE WAR OF INDEPENDENCE TO THE PRESENT TIME.—The national history of the leading Latin-American states with special attention to political parties, existing governments and relations with Europe and the United States. A study of the old régime in Texas, Mexico and California. *Three times a week; second semester.*

Assistant Professor ROBERTSON.

POLITICAL SCIENCE

Graduate work in political science is conducted in the following special fields: (1) Political theory; (2) international law and diplomacy; (3) comparative government; (4) constitutional law, administrative law and jurisprudence; (5) municipal administration.

No student is considered qualified to carry graduate work in political science who has not had at least the equivalent of the introductory college course in government and history. A reading knowledge of German and French is highly desirable and in some of the courses is indispensable.

A student making political science his major may by special permission take one of his minors in the same department, and may select one of the above groups as his major and one as a minor.

If a student making political science his major is taking both of his minors in other departments, one of them must be either in history, economics or sociology.

Several courses given in other departments are so closely related to those in political science that graduate students whose major is political science may be permitted with the consent of the department to take such courses and count them as a part of their work. Among these courses are: Economics 5 (Public Finance); History 4 (English Constitutional History); History 14 (Making of the Federal Constitution); History 27 (History of Latin-America); History 111 (Spanish-American Diplomacy); Sociology 6 (Problems of Urban Communities); Sociology 9 (Criminology); Law 24 (Municipal Corporations). In this connection attention may also be called to the technical courses given by the Department of Municipal and Sanitary Engineering.

Courses for Graduates

101. History of Political Theories.—Development and history of ancient, medieval, and modern political thought. Political theories of Aristotle, Machiavelli, Hobbes, Locke, Rousseau, Montesquieu, and others; evolution

of American Political ideas. *Twice a week; first semester. One unit.* Professor GARNER.

[This course is given in alternate years; Course 102 will be given in its place in 1914-15.]

102. THE NATURE OF THE STATE.—The principles, methods and relations of political service; the origin, nature, forms and functions of the State; sovereignty and liberty; citizenship and nationality; constitutions; principles of political organization. *Twice a week; first semester. One unit.* Professor GARNER.

103. SEMINAR IN POLITICAL SCIENCE AND PUBLIC LAW. *Once a week; both semesters. Credit value depends upon amount of work done.*

Members of the Department.

104. MUNICIPAL ADMINISTRATION.—Studies in municipal organization and functions in the United States and Europe; the relations between city and state, local organization, political methods and reform movements, police and health administration, public works, municipal ownership and public utilities, municipal finances. The particular topics considered differ from year to year. *Twice a week; second semester. One unit.* Professor FAIRLIE.

105. SPECIAL TOPICS IN CONSTITUTIONAL LAW OF THE UNITED STATES.—For 1914-1915 the subject for discussion is the development of federal power. *Twice a week; second semester. One unit.* Assistant Professor DODD.

Courses for Graduates and Advanced Undergraduates

4. MUNICIPAL GOVERNMENT.—The growth of cities; municipal home rule; municipal organization and functions in the United States; the mayor and council; commission government; police, light and water supply; city planning; urban transportation; municipal ownership and regulation of public utilities. *Three times a week; first semester.*

Professor FAIRLIE.

5. CONSTITUTIONAL LAW OF THE UNITED STATES. *Four times a week; first semester.*

Assistant Professor DODD.

6. INTERNATIONAL LAW. *Three times a week; first semester.* Professor GARNER.

7. American Diplomacy.—A study of genesis and present organization of the Department of State; the diplomatic service; the treaty making power; the methods and traditional principles of the foreign policy of the United States; historical review of the principal diplomatic controversies between the United States and foreign powers from the foundation of the government to the present time; the rise of the United States to the position of a world power. *Twice a week; second semester.* Dr. Mathews.

9. Principles of Jurisprudence.—The nature of law; historical development of the English legal system; English common law in the United States; sources of law and relation between statutes and judicial decisions; brief discussions of the various branches of law (crime, tort, contract, etc.) and their relation to one another. *Three times a week; first semester.* Assistant Professor Dodd.

10. Administrative Law in the United States.—Separation of governmental powers and the delegation of legislative power; federal and state administrative organs; methods of enforcing governmental commands; remedies of the individual against unlawful action by public officers. *Three times a week; second semester.*
Assistant Professor Dodd.

11. Constitutional Aspects of Social and Industrial Problems.—The police; constitutional limitations upon legislation concerning the public health and safety; the control of public service corporations and combinations of capital and labor. *Three times a week; second semester.*
Assistant Professor Dodd.

12. National Administration in the United States.—A study of the President and his Cabinet; the executive departments and the administrative services of the national government, etc. *Three times a week; second semester.* Professor Fairlie.

13. State Administration in the United States.—The administrative position of the governor, and the organization of the state administrative departments. Organization and powers of state boards, commissions and quasi-judicial tribunals. Tendencies toward centralization in

state functions. Methods of control over state administrative officers. *Three times a week; first semester.*
Dr. MATHEWS.

14. POLITICAL PARTIES.—A study of the development of political parties and their organization and influence on the government mainly of Great Britain and the United States, with attention to recent legislation in primaries and nomination methods in this country. *Twice a week; first semester.* Professor FAIRLIE.

21. BRITISH GOVERNMENT.—Political institutions in the United Kingdom and British Possessions. *Three times a week; first semester.* Professor FAIRLIE.

22. CONTINENTAL EUROPEAN GOVERNMENT.—A comparative study of the national political systems of France, Germany, Italy, Austria-Hungary and Switzerland. *Three times a week; second semester.* Professor GARNER.

28. PROBLEMS OF CONTEMPORARY POLITICS.—The initiative and the referendum; proportional representation; state socialism; universal suffrage; electoral reform; local self-government; judicial reform; parliamentary government; the Monroe Doctrine, etc. *Twice a week; second semester.* Professor GARNER.

SOCIOLOGY

Preparation for graduate work in sociology must include at least the equivalent of twelve semester hours in the social sciences, of which at least three must be in sociology, and three in the principles of economics. The remainder may be in any combination of these two subjects, or of history and political science.

The graduate courses in this department are of two classes. Those of the first class deal with the principles of general sociology; these principles relate to the essential nature of customs, institutions, and other forms of social activity, the correlations between them, the types of causes by which they are affected, and the method by which they are evolved, all of which apply equally to the forms of social activity whether they are employed in the service of economic, political, or other purposes. The courses of the

second class treat, in the light of the principles of general sociology, the practical social problems of the present.

The library has most of the standard works in general sociology by American, English, and European authorities, a large collection of books on various sociological problems, and an extensive list of periodicals. Special attention is given to ethnographic and anthropologic materials.

Courses for Graduates

101. Sociological Method.—The method of advancing sociological knowledge; adaptability to sociological investigation of certain methods described in Pearson's *Grammar of Science,* Wundt's *Methodenlehre, zweite abtheilung,* Seignobos' *La Méthode Historique Appliquée aux Sciences Sociales,* Bernheim's *Historische Méthode,* Spencer's *Study of Sociology,* and Giddings' *Inductive Sociology. Three times a week; first semester. One unit.*

Professor Hayes.

102. The Development of Sociology.—A reading course in the works of writers who have contributed most to the development of sociology, with discussions and supplementary lectures. *One session, two hours, each week; both semesters. One unit.* Professor Hayes.

150. Seminar. *One session of two hours each week; both semesters. One to two units.* Professor Hayes.

(Note: One of the three courses above described will be omitted in 1914-1915; which one is omitted will depend upon the election of students.)

Courses for Graduates and Advanced Undergraduates

11. Principles of Sociology.—Fundamental principles and main teachings of sociology, derived from a minute analysis and classification of the elements that make up the life of a people, types of change to which they are subject, and causes by which they are affected. *Three times a week; first semester.* Professor Hayes.

3. Social Evolution.—A course for students who desire acquaintance with the comparative method of dealing with questions of theory in the social sciences, presenting a large body of facts concerning the various forms of social

activity, mainly in their more primitive stages as shown by savage and barbarous peoples, with inductions from such facts concerning the theory of social evolution and the method of progress. *Three times a week; second semester.* Professor HAYES

8. CHARITIES.—Brief study of the evolution of modern organized philanthropy, public and private; causes and prevention of poverty; organization and management of charitable institutions. *Three times a week; first semester.* Dr. TODD.

9. CRIMINOLOGY.—Nature, causes, and treatment of the criminal; evolution of modern method of criminal procedure and penology; recent experiments and tendencies. *Three times a week; second semester.* Dr. TODD.

10. POPULATION.—Theories and policies of population; Malthus' "Principle" and its critics; problems in population of the United States; immigration, race mixture, conditions affecting public health, death-rate, birth-rate, "race-suicide," marriage, divorce, etc.; selective influences at work on the "Population type." *Three times a week; first semester.* Dr. TODD.

15. THE FAMILY.—Evolution of the family and marriage; educational, moral, and political significance of the family at different stages of social development. *Twice a week; both semesters.* Dr. TODD.

26. SOCIAL EDUCATION.—Education as a factor in social progress. Present day education policy and organization in the light of theoretical and applied sociology. *Three times a week; second semester.* Dr. TODD.

12. LABOR PROBLEMS.—See Economics 12.

21. SOCIALISM AND SOCIAL REFORM.—See Economics 21.

C. Education, Philosophy and Psychology

EDUCATION

Students who elect education as a major subject must have completed at least a three-hour course in the principles of education, a course of at least the same length in the history of education, and a minimum of three hours each in psychology and philosophy. For graduate students who

have had experience in teaching, these requirements may be modified.

Courses for Graduates

105. SEMINARY IN THE HISTORY OF EDUCATION.—A research course utilizing the materials represented by the Aron educational library, the text-book library, and other collections in the possession of the University. *First and second semesters. Arrange hours and unit values.*

106. SEMINARY IN SECONDARY EDUCATION.—Problems in the organization, administration, and special methods of secondary education; general supervision of special work in independent investigations by students prepared to do advanced work. *Once a week; first semester. One unit.*
Professor JOHNSTON.

108. THE HISTORY OF INDUSTRIAL AND VOCATIONAL EDUCATION.—The development of the ideals, institutions, and methods of training for occupations, with particular reference to the development of industrial schools in Europe and America since the industrial revolution. *Second semester. One unit.*

104. SEMINARY, ADMINISTRATION AND SUPERVISION.—Reading and discussion of technical monographs dealing with the various aspects of educational administration and supervision; the topics include school finance, retardation, measurement of educational products, educational surveys, the rating of teachers, etc.; each member of the seminary will be expected to prepare a report upon some specific phase of administration. *Once a week; second semester. One unit.*
Professor COFFMAN.

111. PRACTICE TEACHING.
[Not given in 1914-15.]

112. PRINCIPLES OF EDUCATION.—A course for graduate students who are not majoring in education and who have not taken the introductory undergraduate courses in education involving (1) a brief survey of the American educational system; (2) a statement of the leading principles and doctrines of educational science; (3) a brief reference to the technique of teaching and the problems of class management. *Twice a week; first semester. Half unit.*
Professor BAGLEY.

114. The Organization and Methods of Higher Education.—The development of normal schools, colleges, and universities; the place of these institutions in national and state systems of education; their legal status; forms of administration; problems of internal organization. This course is intended primarily for those advanced students who are planning to teach in special departments of higher education but who may desire some acquaintance with the general field and its problems. *Twice a week; second semester; one unit.* Professor Johnston.

119. The Elementary Curriculum.—An intensive study of the materials and methods of instruction in the elementary school, and a survey of the principles underlying the organization of the elementary curriculum. *Three times a week; second semester. One unit.*

Professor Coffman.

125. Seminary in Educational Psychology.—A study of the monographic literature in educational psychology with particular emphasis upon the following topics: instinct, habit, memory, the transfer of training, and the psychology of the higher thought processes; typical investigations in the psychology of the different school subjects are also included. *Twice a week; second semester. One unit.* Professor Bagley.

Courses for Graduates and Advanced Undergraduates

6. Principles of Secondary Education.—An elementary treatment of the whole field of secondary education with chief emphasis upon the high school problems of America and Illinois; the history, special function, organization, management, examples of reorganization and the present outstanding issues in this mode of public education. Typical problems treated are: college entrance requirements, differentiated curricula, sex segregation, moral education, changing standards of educational values, special schools, and the "single" or "dual" form of administration. *Three times a week; first semester.* Professor Johnston.

7. The Social Administration of the Modern American High School.—A study of the evolution of the

high school and the current conceptions of secondary education; its relationship to the state and its legal status, and its articulation with the elementary school, with the college and technical school, with the community, and with the home. Other typical problems to be considered are the teaching staff, reorganizations of curricula, "controls" of instruction, direction of student activities, and the administration of vocational and moral guidance; school journalism, debating activities, athletics, and medical inspection. *Three times a week; second semester.*

Professor JOHNSTON.

18. METHOD IN EDUCATIONAL RESEARCH.—The principles and technique of the statistical method as applied to educational investigation. *Twice a week; second semester.*

Professor COFFMAN.

4. GENERAL EDUCATIONAL ADMINISTRATION.—A survey of educational systems, with especial reference to administrative problems in the elementary school. *Three times a week; first semester.* Professor COFFMAN.

27. HIGH SCHOOL CURRICULA.—A study of the bases upon which high school curricula should be constructed, the principles of professional supervision, the materials, text books, and other devices approved for modern secondary school work, and special treatment of the psychology of the mental processes involved in selected high school branches of study. *Three times a week; second semester.*

Professor JOHNSTON.

20a. THEORY OF SUPERVISION.—Principles and methods involved in the training of teachers in service. *Three times a week; second semester.* Professor COFFMAN.

20b. THEORY AND PRACTICE OF SUPERVISION.—Education 20a with two additional hours devoted to the inspection and criticism of teaching. *Five times a week; second semester.* Professor COFFMAN.

41. VOCATIONAL EDUCATION.—An examination of the institutions and methods of vocational and industrial education. *Twice a week; first semester.* Professor JOHNSTON

42. AUXILIARY EDUCATION.—An examination of the institutions and methods involved in the training of defectives and delinquents.

5a. Comparative Education (General).—A comparative study of the educational systems of the United States, Canada, Great Britain, Germany, France, Austria, Italy, and Japan, with especial reference to elementary education. *Three times a week; first semester.*

5b. Comparative Education (Secondary).—A comparative study of secondary schools in the principal civilized countries. *Three times a week; second semester.*

Professor Johnston.

13a. Educational Classics.—A study of the writings of the educational reformers from Plato to Locke. *Three times a week; first semester.*

13b. Educational Classics.—A study of the writings of educational reformers from Locke to the present time. *Three times a week; second semester.*

12. History of American Education.—The origin and development of the state systems of common schools. *Twice a week; first semester. Half unit.*

PHILOSOPHY

Every student entering upon graduate work in philosophy must have had a thorough general course in the history of philosophy and a course in logic. A general course in psychology is also required.

Courses for Graduates

101. The Philosophy of Plato and Aristotle. *Twice a week; first semester. One unit.*

Professor Daniels.

[Not given in 1914-15.]

102. Seminar.—Contemporary philosophy. Theories of consciousness. *Twice a week; both semesters. One unit.*

Professor Bode.

103. Seminar.—Ethical theory. *Twice a week; first and second semesters. One unit.* Professor Daniels.

[Not given in 1914-15.]

104. The Philosophy of Descartes, Spinoza and Leibniz. *Twice a week; first semester. One unit.*

Professor Daniels.

105. The Philosophy of Kant and Schopenhauer. *Twice a week; second semester. One unit.*
Professor Daniels.

Courses for Graduates and Advanced Undergraduates

3. History of Ancient and Medieval Philosophy. *Three times a week; first semester.* Professor Daniels.

4. History of Modern Philosophy. *Three times a week; second semester.* Professor Daniels.

7. Ethics.—The beginning and growth of morality; analysis, and criticism of the leading conceptions of moral theory; discussion of some of the typical social and economic problems of the present. *Three times a week; second semester.* Professor Daniels.

11. Philosophy of Religion.—The philosophical interpretation of religious consciousness and a critical study of various religious concepts: God, revelation, inspiration, dogma, faith, prayer, immortality, the problem of evil, the relation of morality and religion. *Twice a week; second semester.* Professor Daniels.

15. The British Philosophers of the Eighteenth Century.—Locke, Berkeley and Hume. *Three times a week; first semester.* Professor Bode.

16. American Philosophy. *Twice a week; second semester.* Professor Bode.

17. Advanced Logic. *Three times a week; first semester.* Dr. Shepherd.

18. Logical Theory in its Bearing on Philosophic Problems. *Three times a week; second semester.*
Dr. Shepherd.

19. The Development of Religious Thought in the Eighteenth and Nineteenth Centuries. *Three times a week; first semester.* Dr. Shepherd.

PSYCHOLOGY

No student may do graduate work in psychology without having had at least six hours in elementary psychology, and at least one three-hour course in philosophy.

Courses for Graduates

103-4. RESEARCH.—Experimental and historical investigations. Theses offered for advanced degrees. *Both semesters.*

Professor BENTLEY, Dr. SUTHERLAND, Dr. RUCKMICH.

105-6. SEMINARY.—Essays and discussions. Consideration of systematic questions. *Both semesters.*

Professor BENTLEY.

107-8. ADVANCED PSYCHOLOGY.—A critical and systematic survey of the field of psychology, designed especially for candidates seeking advanced degrees. Lectures, conferences, essays. *Three times a week; both semesters. One unit.* Professor BENTLEY, Dr. RUCKMICH.

Courses for Graduates and Advanced Undergraduates

5-6. COMPARATIVE PSYCHOLOGY.—Study of consciousness in the animal forms. Laboratory drill and research. *Twice a week; both semesters.*

Professor BENTLEY, Dr. RUCKMICH, Dr. VANCE.

7. IMAGE AND IMAGINATION.—The image and its functions. Types of imagery. The forms of imagination. *Twice a week; first semester.* Dr. SUTHERLAND.

8. MEMORY AND ASSOCIATION.—The forms of the associative consciousness, and their development. Methods for the study of memory. *Twice a week; second semester.* Dr. SUTHERLAND.

10. GERMAN READING.—The accurate translation of technical German treatises upon psychological subjects. *Once a week; first semester.* Professor BENTLEY.

11. STUDIES IN MENTAL DEVELOPMENT.—First-hand inspection of developmental changes in consciousness. Literature of skill and efficiency. *Three times a week; first semester.* Dr. SUTHERLAND.

12. MINOR PROBLEMS.—Advanced experimental and literary studies. *Two to five times a week; both semesters.*

Professor BENTLEY, Dr. SUTHERLAND, Dr. RUCKMICH.

15. THE PSYCHOLOGICAL BASIS OF MUSIC.—The experimental and theoretical literature of harmony, melody,

rhythm, consonance. The psychological factors involved in the production and the appreciation of music. *Twice a week; both semesters.* Dr. RUCKMICH.

D. The Sciences, Including Mathematics

ASTRONOMY

The prerequisites for graduate study in astronomy are mathematics through the calculus, a year's course in observational astronomy, and a course in college physics.

Courses for Graduates

101. SEMINAR. *Three times a week; both semesters. One unit.* Professor STEBBINS.

102. STELLAR ASTRONOMY.—Orbits of binary stars; variable stars; theoretical photometry. *Three times a week; both semesters. One unit.* Professor STEBBINS.

Courses for Graduates and Advanced Undergraduates

7. THEORETICAL ASTRONOMY.—Celestial mechanics; theory of orbits; perturbations; canonical transformations. *Three times a week; both semesters. One unit.* Dr. REED.

9. CELESTIAL MECHANICS.—Properties of canonical systems of differential equations; integration by series; periodic and asymptotic solutions; integral invariants. *Three times a week; both semesters. One unit.* Dr. REED.

14. OBSERVATIONAL ASTRONOMY.—The working methods of an astronomical observatory; individual problems. *Three times a week; second semester. One unit.* Professor STEBBINS.

15. GEODETIC ASTRONOMY.—The sextant, transit, and zenith telescope; methods similar to those of the United States Coast Survey. *Three times a week; first semester. One unit.* Professor STEBBINS.

BACTERIOLOGY

Courses for Graduates

The work outlined under "Courses for Graduates" is open only to graduate students who have had at least one

year's work in bacteriology, and a good training in chemistry.

103. Physiology of Bacteria.—Theories of fermentation, growth and death of bacteria. *Twice a week; second semester. One unit.* Assistant Professor Rahn.

105. Classification of Bacteria.—Variability of species characters, mutations, standard and biometric classification. *Twice a week; second semester. One unit.* Assistant Professor Rahn.

107. Research in Bacteriology.—Research in physiology of bacteria and in food bacteriology. *Once a week; both semesters. One or two units.* Assistant Professor Rahn.

Courses for Graduates and Advanced Undergraduates

Graduate students in Agriculture, biology or chemistry who have had no bacteriology may choose Botany 19 as an introductory course. This, or Botany 5, is prerequisite for the other courses.

8. Applied Bacteriology.—Decay of organic matter in nature; water bacteriology; sewage bacteriology; food bacteriology; pathologic bacteriology. *Twice a week; second semester.* Assistant Professor Rahn.

18. Journal Meeting.—Required of all students specializing in bacteriology. *Once a week; both semesters.* Assistant Professor Rahn.

19. General Bacteriology.—The essentials of the science especially arranged for graduate students. *Twice a week; both semesters.* Assistant Professor Rahn.

BOTANY

Courses for Graduates

The work outlined under "Courses for Graduates" is open only to those who have had liberal botanical training including at least one year of successful study in the particular line in which it is desired further to specialize. These courses may be elected for minor or for major work.

101. Cytology.—The influence of external agents on the cell. Special subjects for investigation are assigned

upon consultation. Reports and discussions of current literature and research results. *Once a week; both semesters. One or two units.* Professor HOTTES.

102. PHYSIOLOGY.—The effects of external stimuli on growth and movement. Special subjects for investigation are assigned upon consultation. Reports and discussions of current literature and research results. *Once a week; both semesters. One or two units.* Professor HOTTES.

104. MYCOLOGY.—Field and laboratory investigations upon selected groups of fungi. Individual assignments of subjects and problems. *Once a week; both semesters. One or two units.* Professor STEVENS.

106. PLANT PATHOLOGY.—Diseases of plants, and disease agents. Special subjects are assigned upon consultation. *Once a week; both semesters. One or two units.* Professor STEVENS.

108. TAXONOMY.—Monographic studies of critical groups. *Once a week; both semesters. One or two units.* Professor TRELEASE.

Courses for Graduates and Advanced Undergraduates

After at least one year of approved botanical work and further prerequisites, on consultation graduates may elect the following courses, with assigned additions, for minor credit.

3. CYTOLOGY AND PHYSIOLOGY.—The first semester is devoted mainly to cytology and histology, with special attention to technique; the second, to a study of influences of external stimuli on growth and movement. *Twice a week; both semesters.* Professor HOTTES.

7. PLANT PATHOLOGY.—First semester: the more important diseases of cultivated plants, the causes, and their effects upon the hosts. Second semester: methods of investigation and control. *Twice a week; both semesters.* Professor STEVENS.

9. CYTOLOGY AND PHYSIOLOGY (ADVANCED COURSE).—Special laboratory problems in certain phases of cytology and physiology. *Twice a week; both semesters.* Professor HOTTES.

10. Current Literature.—Reports and discussions upon assigned topics and results of research work. *Once a week; both semesters.*

Professors Trelease, Hottes, Stevens.

16. Lower Plants.—Field, laboratory and herbarium work and assigned reading on special groups. *Twice a week; both semesters.* Professor Stevens, Dr. Hague.

17. Taxonomic and Descriptive Practice.—Monographic treatment of selected natural or ecologic groups of higher plants. Laboratory and field work with assigned reading and seminar conferences. *Twice a week; both semesters.* Professor Trelease.

CERAMICS

Courses for Graduates

Persons desiring work in advanced silicate technology must be graduates of courses in ceramics, chemical engineering or general science. Students who are graduates in general science are required to show sufficient training in inorganic and physical chemistry, mathematics, physics, mineralogy and geology to warrant the expectation that they will be able to do the work elected by them.

101. The Formation of Silicates, involving the conceptions of physical chemistry. Lectures; laboratory. *Five times a week; first semester. One unit.* Mr. Stull.

102. The Technology of the Clay Industries.—Mineralogical constitution of clays; plasticity and the colloidal state; pyro-chemical and physical changes; the composition and constitution of glazes; dissolved and underglaze colors; eutectic studies. *Three times a week; both semesters. One unit.* Mr. Stull.

104. The Technology of Glass.—Fusion curves of glassy silicates; limiting compositions; solubility of the oxides in glasses; devitrification; annealing; optical properties; solubility of glass; viscosity. *Twice a week; second semester. Half unit.* Mr. Stull.

Courses for Graduates and Undergraduates

Graduates of courses other than ceramics or ceramic engineering may take the following courses for minor credit.

3. Industrial Calculations.—The designing and op-

eration of furnaces, kilns and dryers; temperature measurement. *Three times a week; first semester.*
Mr. HURSH.

5. BODY MAKING.—Composition of ceramic wares; physical and chemical changes produced by the blending of the various ceramic materials; machinery and processes employed in shaping the various products. *Five times a week; second semester.* Mr. STULL, Mr. RADCLIFFE.

6. GLAZES.—The production of glazes and enamels; classification; properties and defects common to each class; the effect of variation in composition; modes of application. *Five times a week; first semester.* Mr. STULL.

8. PRINCIPLES OF GLASS MANUFACTURE.—The raw materials, preparation, compounding, melting and shaping of glass; chemical principles involved in the manufacture and decoration of the different types of vitreous silicates. *Three times a week; second semester.* Mr. STULL.

10. CEMENTS.—Limes, plasters, cements, sand-lime stone, and other cementing materials; composition, reactions, methods of manufacture and testing. *Three times a week; first semester.* Mr. HURSH.

14. CEMENT LABORATORY.—The production of waterproof and sea resisting cements; cement colloids; polychrome pigments for fresco decoration; cement colors; cold water paints. *Three times a week; second semester.*
Mr. HURSH.

CHEMISTRY

Graduate students whose major subject is in some other department than chemistry, before taking graduate work for credit in this department, must have had the equivalent of 15 University hours in chemistry, and the ground covered must have included satisfactory work in general chemistry and in qualitative and quantitative analysis. Such students are advised to take Chemistry 31, 33, (or 102, 102a), 5b, 5c, 15, 14, and 9a and 9b. Courses of a more special nature will not, as a rule, be accepted for graduate work unless preceded by one of the above courses.

Graduate students who are candidates for an advanced degree in chemistry must have had the equivalent of 30 University hours in chemistry, and this must include satis-

factory courses in general chemistry, qualitative and quantitative analysis, physical chemistry, and organic chemistry. They should have had courses in mathematics, including analytical geometry and, if possible, the calculus. The physical chemistry requires one year's work in physics as a prerequisite. Before receiving the degree of Doctor of Philosophy such students are expected to complete work equivalent to courses 31, 33 (or 102 and 102a), 14, 9a, 9b, 101 and 111. They are advised to take at least brief courses in gas analysis, iron and steel analysis, water analysis, assaying and chemical technology.

For students in chemistry, 5a, 13a, 9 and 9c will not be accepted for graduate credit and 9a, 9b, 14, 31 and 33 will be accepted only from the students entering the Graduate School with the equivalent of 30 University hours in chemistry.

Courses for Graduates

101. HISTORY OF CHEMISTRY.—Lectures. Pattison Muir's *History of Chemical Theories and Laws,* and assigned reading. *Twice a week; first semester. Half unit.*
Assistant Professor SMITH.

102. ADVANCED PHYSICAL CHEMISTRY.—This course consists of lectures and seminar meetings and, together with 102a, is intended to cover a period of two years. The subject is treated from the standpoint of Avogadro's *Principle and Thermodynamics.*

The primary purpose of this course is to develop power to handle successfully a physico-chemical problem rather than merely to impart a knowledge of the phenomena and the principles involved. Nernst's *Theoretische Chemie,* 7th edition. *Twice a week; both semesters. Three-quarters unit.*
Professor WASHBURN.

102a. ADVANCED PHYSICAL CHEMISTRY.—Chemical equilibrium; the Phase Rule; certain portions of thermochemistry; photochemistry; the thermodynamics of electrochemistry. (A continuation of 102, with which it alternates.) Nernst's *Theoretische Chemie. Twice a week; both semesters. Three-quarters unit.*
Professor WASHBURN.

[Not given in 1914-15.]

102b. Advanced Electrochemistry.—The modern theories of solution and the principles of thermodynamics in their application to the problems of electrochemistry; electrolytic conductivity and transference; electro-motive force; the energy principles underlying the transformation of chemical and electrical energy; the recent advances in the electrolysis of fused electrolytes and the applications of electricity to gaseous reactions at high temperature. LeBlanc's *Electrochemistry. Three times a week; second semester. One unit.* Dr. MacInnes.

102c. Advanced Physical and Electrochemistry.—A laboratory course dealing with the application of physico-chemical methods to special problems. This course must be preceded or accompanied by Chemistry 102, 102a, or 102b. *Twice a week; first semester. Three-quarters unit.* Professor Washburn, Dr. MacInnes.

102d. Electrochemistry.—This course, which is intended primarily for students of electrical engineering, includes a discussion of theoretical and applied electrochemistry with the emphasis chiefly on the technical side of the subject. *Once a week; both semesters. Half unit.* Dr. MacInnes.

102e. Special Topics in Physical Chemistry.—A detailed study of certain branches of physical chemistry and its applications will be taken up in this course. The course will be conducted on the seminar plan and the topics considered will vary from year to year. Subject for 1914-1915: Free Energy and the Nernst Heat Theorem. *Once a week; first semester. Half unit.* Professor Washburn.

103. Advanced Inorganic Chemistry.—Descriptive inorganic chemistry; the rarer elements; the periodic system. Lectures, with or without laboratory work. *Two to five times a week; both semesters. One half to one and one-fourth units.* Professor Balke.

103a. Advanced Analytical Chemistry.—Special topics; lectures, with or without laboratory. *One to five times a week; second semester. One half to one and one-quarter units.* Assistant Professor Smith.

103b. Special Topics in Inorganic Chemistry.—Lectures and Seminar. Subject for 1914-1915: The In-

vestigations and Theories of Werner. Werner, *Neuere Anchauungen auf dem Gebiete der anorganischen Chemie*, together with assigned reading from later publications. *Twice a week; first semester. Three-quarters unit.*

Assistant Professor SMITH.

103c. SPECIAL TOPICS IN INORGANIC CHEMISTRY.—Seminar. The Determination of Atomic Weights. *Twice a week; second semester. Three-quarters unit.*

Professor BALKE

103d. ADVANCED QUALITATIVE ANALYSIS.—Methods of examining qualitative reagents; reactions of some of the less common elements. Designed especially for those intending to teach qualitative chemistry. Lectures, with or without laboratory. *One to three times a week; first semester. One-half to one unit.* Assistant Professor WEBER.

104. ADVANCED ORGANIC CHEMISTRY.—Seminar with laboratory. Kekule's linking theory, stereochemistry, steric hindrance, molecular rearrangements, tautomerism, condensation, carbohydrates, ureids. Special attention is given to the application of modern physical chemistry to the study of organic problems, especially the application of chemical kinetics to tautomerism and to the typical reactions of organic chemistry, and the application of physical properties to the determination of chemical structure. *Twice a week; both semesters. Three-quarters unit.*

Assistant Professor DERICK, Dr. THORP.

104a. ADVANCED ORGANIC CHEMISTRY.—(Continuation of 104, with which it alternates.) *Twice a week; both semesters. Three-quarters unit.*

Assistant Professor DERICK, Dr. THORP.

[Not given in 1914-15.]

104b. ADVANCED QUANTITATIVE ORGANIC ANALYSIS.—The quantitative chemistry of the proteins, alkaloids, glucosides, volatile oils, and other constituents of animal and vegetable tissues. Plant analysis. Toxicological analysis. Concludes with a study of the general methods, chemical and physical, of organic analysis. Lectures and seminar. May be accompanied by laboratory work on a selected group of compounds. *Twice a week; both semesters. Three-quarters unit.* Dr. BEAL.

104c. Special Topics in Organic Chemistry.—Seminar in which recent books dealing with special phases of organic chemistry are read and discussed. Topic for 1914-1915: *The Organic Chemistry of Nitrogen,* Sidgwick. *Once a week; first semester. Half unit.*

Assistant Professor Derick, Dr. Thorp.

105. Advanced Physiological Chemistry.—Selected portions of physiological chemistry not covered by Chemistry 15. *Twice a week; second semester. Three-quarters unit.* Mr. Mac Arthur.

105a. Advanced Physiological Chemistry.—Special investigations. Laboratory. *One to five times a week; second semester. Three-quarters unit.*

Mr. Mac Arthur.

105b. Advanced Physiological Chemistry.—A critical consideration of recent contributions of importance in the field of physiological chemistry. *Twice a week; both semesters. Three-quarters unit.* Mr. Mac Arthur.

106. Animal Chemistry (Animal Nutrition).—The recent advances in the chemistry of nutrition of the lower animals; the chemistry of the functional products: the flesh, fat, milk, and wool of the more common domesticated animals. Lectures; conferences; assigned reading; laboratory. *Five times a week; both semesters. One to one and one-half units.* Professor Grindley

107. Calorimetry.—Standards and methods. *One to three times a week; both semesters. One-half to one unit.*

Professor Parr.

108. Advanced Metallography.—Advanced studies in the constitution and microstructure of metals and alloys; the relations between their properties, chemical and mechanical treatment, and structure. Assigned reading, and laboratory. *Twice a week; second semester. Three-quarters unit.*

Assistant Professor McFarland.

109. Advanced Industrial Chemistry.—Seminar. A detailed study of some of the more important chemical industries, and the development and chemical control of processes. *Twice a week; both semesters. Three-quarters unit.*

Assistant Professor McFarland.

110. Water Supplies.—A study of the sources of con-

tamination of water supplies and the purification of water for potable or technical use. *One to five times a week; both semesters. One-half to one and one-quarter units.*

Professor BARTOW.

111. RESEARCH. *Once a week; both semesters.*

PHYSICAL AND ELECTROCHEMISTRY. Professor WASHBURN, Dr. MACINNES.

INORGANIC CHEMISTRY. Professor BALKE, Assistant Professors SMITH, WEBER.

ANALYTICAL CHEMISTRY. Assistant Professor SMITH.

FOOD CHEMISTRY. Dr. BEAL.

ORGANIC CHEMISTRY. Professor NOYES, Assistant Professor DERICK, Dr. THORP.

WATER CHEMISTRY. Professor BARTOW.

PHYSIOLOGICAL CHEMISTRY. Mr. MAC ARTHUR.

ANIMAL CHEMISTRY NUTRITION. Professor GRINDLEY.

INDUSTRIAL CHEMISTRY. Professor PARR, Assistant Professor MCFARLAND.

Courses for Graduates and Advanced Undergraduates

5c. FOOD ANALYSIS.—Quantitative organic analysis, with special reference to the examination of food and drug products: alcohols, carbohydrates, fats and oils, animal and vegetable foods, nitrogenous bodies, preservatives, and colors. Sherman's *Organic Analysis; "Bulletin 107, rev., U. S. Bureau of Chemistry." Five times a week; second semester.*

Dr. BEAL.

*6. CHEMICAL TECHNOLOGY.—Technological chemistry as illustrated in those industries having a chemical basis for their principal operations and processes; trade journals. Lectures and recitations. Rogers' and Aubert's *Industrial Chemistry. Twice a week; second semester.*

Assistant Professor MCFARLAND.

*7. METALLURGY.—Lectures, assigned reading, and recitations. The time of the course will be divided about equally between general metallurgy, metallurgy of iron and

*Certain inspection trips will be arranged in connection with courses 6 and 7. Students registering in these courses should take into consideration the expense involved, which will approximate $15.00 for each course.

steel, and metallurgy of the non-ferrous metals. Fulton's *Principles of Metallurgy* and Stoughton's *Iron and Steel. Three times a week; first semester.*

Assistant Professor McFARLAND.

8. IRON AND STEEL ANALYSIS.—Analyses of all the constituents by both rapid, or technical, and standard methods. *Three times a week; second semester.*

Assistant Professor SMITH.

9a. ORGANIC SYNTHESIS AND ULTIMATE ANALYSIS.—Ultimate organic analysis; the preparation and study of typical organic compounds. Laboratory. *Twice a week; first semester.*

Assistant Professor DERICK, Dr. THORP, Mr. KAMM.

9b. ORGANIC SYNTHESIS AND QUALITATIVE ORGANIC ANALYSIS.—Continuation of 9a, to accompany Chemistry 14. *Twice a week; second semester.*

Assistant Professor DERICK, Dr. THORP, Mr. KAMM.

10a. STUDY OF WATER SUPPLIES.—Lectures on history, sources, contamination, and standards of purity of potable waters and waters for industrial purposes, together with practice in analytical methods. *Three times a week; second semester.* Professor BARTOW.

13b. ADVANCED AGRICULTURAL ANALYSIS.—This course is ordered to students who wish to specialize in agricultural chemistry. Applied quantitative analysis. The analysis of fungicides, limestone, phosphate rock, fuel and water, determination of the alkali metals, special methods of agricultural analysis. Treadwell-Hall, *Analytical Chemistry*, Vol. II. *Five times a week; second semester.* Dr. BEAL.

14. ORGANIC CHEMISTRY. — Lectures; recitations. Noyes's *Organic Chemistry*. This course should be accompanied by Chemistry 9a and 9b. *Three times a week; both semesters.* Professor NOYES.

15. PHYSIOLOGICAL CHEMISTRY.—Enzymes; carbohydrates; salivary digestion; gastric digestion; fats; pancreatic digestion; intestinal digestion; bile; putrefaction products; feces; blood; milk; epithelial and connective tissues; muscular tissue; nervous tissue; urine. Qualitative and quantitative work on gastric juice, blood, urine, and milk; the clinical aspects of these topics treated thoroughly for the

prospective student of medicine. Lectures; demonstrations; conferences; practical work; assigned reading. Hammarsten's *Text Book of Physiological Chemistry;* Hawk's *Practical Physiological Chemistry.* (Open to graduates and undergraduates.) *Five times a week; first semester.*

Mr. Mac Arthur.

15a. Problems of Physiological Chemistry (Intended Especially for Medical Students).—Colloids; animal oxidations; osmosis; absorption; selective activity of cells; metabolism; activities of gastro-intestinal tract; enzymes; inorganic nutrition. Lectures; demonstrations; conferences. *Twice a week; second semester.*

Mr. Mac Arthur.

21. Qualitative Organic Analysis. — Systematic methods for identification of pure organic compounds and mixtures. *Twice a week; first semester.*

Assistant Professor Derick, Mr. Kamm.

22. Animal Chemistry (Animal Nutrition.)—The chemical composition of animal products and feeding stuffs. Lectures; conferences; assigned reading; laboratory. *Five times a week; first or second semester.*

Professor Grindley.

27. Qualitative Analysis of the Rare Elements. *Three times a week; second semester.* Professor Balke.

31. Elementary Physical Chemistry. *Three times a week; second semester.* Professor Washburn.

33. Elementary Physical Chemistry.—A laboratory course to accompany course 31. *Twice a week; second semester.* Dr. MacInnes.

35. Electrochemistry. — Lectures and laboratory work. See also Chemistry 102b. *Three times a week; first semester.* Dr. MacInnes.

61. Industrial Chemical Laboratory.—The preparation and purification of chemical products from raw materials on a scale sufficient to afford data for determining the economy of the processes employed. Typical forms of chemical machinery such as filter presses, vacuum pan, centrifugal separators, steam jacketed kettles, etc., will be used and studied, and reports and estimates will be required upon apparatus and plant for the production of some particular

product on a commercial scale. Should be accompanied by either Chemistry 6 or 109. *Twice a week; second semester.* Assistant Professor McFarland and Dr. Broderson.

66. Technology of Gases.—The manufacture, constituents, and uses of the various forms of gaseous fuel; calorimetry; photometry; the more exact methods of analysis. Lectures; reading; reports; laboratory. *Once a week; second semester.* Professor Parr.

68a. Analysis of Glasses and Glazes.—For students in ceramics. A study of methods and practice on special problems connected with the pottery industry. *Three times a week; first semester.* Assistant Professor Smith.

69. Metallurgical Laboratory and Assaying.—The fire assay of gold, silver, lead and copper ores, mattes, and bullion, together with special experiments illustrating the underlying metallurgical principles. Studies of fluxes, slags, and charge calculations, practice in use of coal, oil, and gas furnaces, and in in the measurements of high temperatures. Fulton's *Manual of Fire Assaying. Twice a week; first semester.* Assistant Professor McFarland.

70. Advanced Assaying and Ore Testing.—The assay of ores of platinum, tin, and copper; bullion assay; free milling, amalgamation, and cyaniding tests. (A continuation of Chemistry 69.) *Twice a week; second semester.* Assistant Professor McFarland.

71. Advanced Methods of Metallurgical Analysis.—Study and comparison of selected methods for analyses of ores, alloys and metallurgical products. Laboratory. *Twice a week; first semester.* Assistant Professor McFarland.

72. Paints, Oils, Turpentines, Varnishes and Protective Coverings for Wood and Metals.—Lectures and laboratory. *Two or five times a week; first or second semester.* Professor Parr.

76. Calorimetry of Fuels.—Methods for determining the heat values of solid, liquid, and gaseous fuels. (An advanced course.) *One to three times a week; both semesters.* Professor Parr.

77. Composition and Classification of Coal.—Classification, changes in composition, weathering, spon-

taneous combustion, formation of mine gases. Lectures; assigned reading. *Once a week; second semester.*

Professor PARR.

78. METALLOGRAPHY.—Constitution and microstructure of metals and alloys and on the relations between their properties, chemical and mechanical treatment and structure. Lectures; reading; and laboratory. *Twice a week; second semester.* Assistant Professor MCFARLAND.

93. JOURNAL MEETING.—For seniors, and graduates. *Once a week; both semesters.*

Assistant Professor MCFARLAND.

Besides the formal courses, outlined above, regular scientific meetings are held by the colloquiums of industrial, physical and inorganic, physiological and organic chemistry; by the Chemical Club; by Phi Lambda Upsilon and by the University of Illinios Section of the American Chemical Society.

ENTOMOLOGY

The prerequisite for graduate study of entomology is a year's work in college zoology, or a half year's work in zoology and a year's work in botany. Entrance upon major work in entomology requires the equivalent of Entomology 2 and 3. Courses 108 and 109 require 8 and 9 respectively.

Students are offered an opportunity for work in insect morphology, systematic entomology, and ecological and economic entomology.

The library of the Illinois State Laboratory of Natural History is rich in works dealing with American and European insects. The extensive collections of the Illinois State Laboratory of Natural History and of the State Entomologist's Office are particularly complete in sets of the Illinois species, and contain much material illustrative of life histories, all of which are available for study. The University Museum contains the Bolter collection, especially notable for its long series of Lepidoptera and Coleoptera. It now numbers about 120,000 specimens representing over 16,000 species.

Courses for Graduates

102. RESEARCH IN THE MORPHOLOGY AND EMBRYOLOGY OF INSECTS. *Twice a week; both semesters. One or two units.* Assistant Professor FOLSOM.

103. Research in Faunistic and Ecological Entomology. *Once or twice a week; both semesters. One or two units.* Professor Forbes.

107. Systematic Entomology.—The external and internal anatomy of insects, its bearing on insect taxonomy, and the identification of specimens representing as many as possible of the major and minor groups. *Five times a week; both semesters. One or two units.*

Associate Professor MacGillivray.

108. Research in Economic Entomology. *Once or twice a week; both semesters. One or two units.*

Professor Forbes.

109. Research in Systematic Entomology. *Twice a week; both semesters. One or two units.*

Associate Professor MacGillivray.

Courses for Graduates and Advanced Undergraduates

2. General Entomology.—Field entomology; morphological and physiological entomology; the collection and preservation of specimens; laboratory studies of typical insects; the recognition of adaptive structures and their utilities. (This course and course 3 form a year's work, covering the whole field. Either may be taken independently of the other.) *Five times a week; first semester.*

Assistant Professor Folsom and Associate Professor MacGillivray.

3. General Entomology.—The classification and determination of insects; the study of life histories in the insectary and by field observation; the collection of information with respect to the ecological relations of insects. *Five times a week; second semester.*

Assistant Professor Folsom.

5. Introduction to Research.—Library, language, manuscript, and advanced laboratory work on assigned topics. *Three to five times a week; first or second semesters.*

Professor Forbes, Assistant Professor Folsom and Associate Professor MacGillivray.

8. Economic Entomology.—Field, laboratory, insectary, library, and manuscript work, with practice in some of the special operations of economic entomology. Prepara-

tion for individual study of other classes of insect pests. *Three times a week; both semesters.*

Professor FORBES, Assistant Professor FOLSOM.

10. TAXONOMY OF IMMATURE INSECTS.—A study of the external form of immature insects and the identification of as many species as possible. *Five times a week; first semester.* Associate Professor MACGILLIVRAY.

11. CLASSIFICATION OF THE COCCIDAE.—Methods of preparing scale insects for study, the identification of genera and species, and discussion of their morphology, metamorphosis, and phylogeny. *Five times a week; second semester.* Associate Professor MACGILLIVRAY.

12. CURRENT LITERATURE.—Reports and discussion upon assigned topics; presentation and discussion of contents of recent entomological publications, and of results of personal research. *Once a week; both semesters.*

13. MEDICAL ENTOMOLOGY.—Primarily for advanced students preparing for medicine. A study of insects as related to the transmission of disease. Laboratory observations and experiments, and written reports, with discussions upon literature of the subject. Methods of controlling insects capable of transmitting diseases. *Three times a week; first or second semester.* Assistant Professor FOLSOM.

14. ADVANCED ECONOMIC ENTOMOLOGY. — Personal work, under direction, in the insectary, field, and library, with assigned problems in economic entomology, involving observation, experiment, and inference, note making, record keeping, and the preparation of manuscript. Intended to prepare advanced students for immediate service as entomologists in experiment stations and other state and government positions. Advantage will be taken of the operations and practical problems of the State Entomologist's Office, so far as available for the purposes of this course. *Twice a week; first or second semester, and six weeks of summer vacation.* Professor FORBES.

GEOLOGY

The first prerequisite for graduate work in Geology is the equivalent of the complete undergraduate offerings in that branch of the subject in which specialization is desired.

Those who wish to specialize in paleontology should have, in addition, at least an elementary knowledge of systematic zoology; those who wish physical geography should have a fairly thorough knowledge of general physics and chemistry; and those who expect to pursue work in petrography and economic geology should be well grounded in general physics, inorganic chemistry and the elements of physical chemistry. All graduate students should be sufficiently acquainted with German and French to be able to read the journals printed in these languages.

Courses for Graduates

101. Advanced Crystallography.—This course is intended to familiarize the student in chemistry or mineralogy with the methods used in measuring, prospecting and calculating crystal forms, and determining the physical properties of crystallized bodies. *Three to five times a week; both semesters. One unit.* Professor Bayley.

102. Petrography.—Lectures and laboratory work on the igneous and fragmental rocks; including identification of types, classification and relationships. *Twice a week; both semesters. One unit.* Professor Bayley.

103. Lectures and Laboratory Work on the Crystalline Schists and Other Metamorphis Rocks; Processes of Metamorphism. *Twice a week; both semesters. One unit.* Professor Bayley.

105. Invertebrate Paleontology.—A course devoted to the study of a group of invertebrate fossils, or of the fossils of a special geological system; their geographic distribution and geologic range with reference to stratigraphy. Largely individual work. *One to three times a week; both semesters. One unit.* Assistant Professor Savage.

106. Areal and Stratigraphic Geology.—Consists of a systematic study of the geology and paleontology of a selected area in Illinois. A carefully prepared report on the geology of the region, based on the data collected in the field, is required. *One to three times a week; both semesters. One to two units.* Assistant Professor Savage.

107. Areal and Structural Geology.—Individual work on some area exhibiting important structural or eco-

nomic features. *Once a week; both semesters. One to two units.* Professor BAYLEY.

124. ADVANCED PHYSIOGRAPHY.—Individual work on field problems; study and discussion of the literature of physiography and geomorphology. *One to three times a week; both semesters. One unit.* Dr. RICH.

Courses for Graduates and Advanced Undergraduates

6. PHYSICAL AND OPTICAL MINERALOGY.—An introduction to the courses in petrography. The physical and optical properties of minerals are discussed with special reference to symmetry. The larger portion of the work is devoted to the study of polarized light and its practical use in identifying the rock-forming materials. *Three times a week; first semester.* Professor BAYLEY.

7. PETROGRAPHY.—The principles learned in course 6 are applied to the study of rocks. Lectures describe the different types of rocks and discuss their origin and classification. In the laboratory a representative suite of specimens is studied in the hand specimen and thin section. *Three times a week; second semester.* Professor BAYLEY.

9. PALEONTOLOGY.—A study of invertebrate fossils, their classification and relationships. Instruction is given in the identification of the fossils, and in the finding and use of the literature of the subject. *Five times a week; first semester.* Assistant Professor SAVAGE.

15. STRUCTURAL GEOLOGY.—The arrangement of the rocks which form the earth's crust and their distribution on its surface; mountains; faults; folds; other diastrophic phenomena. *Three times a week; first semester.* Professor BAYLEY.

16. STRATIGRAPHY.—This course follows course 9, and is a study of principles of classifications, of rock formations, of the methods and criteria employed in correlation of the index fossils of the successive geologic formations and their distribution, and of the use of these in the interpretation of stratigraphy. *Five times a week; second semester.* Assistant Professor SAVAGE.

HOUSEHOLD SCIENCE

Students who wish to do graduate work in household science will find it to their advantage to specialize in either the scientific or the economic phases of the subject. In either case they must offer an equivalent of twenty credit hours of household science as given in the University of Illinois, with a minimum of two years of chemistry, including organic chemistry, a year of biological science, and a year of either economics or sociology.

Courses for Graduates

101. HOME ECONOMICS.—A study of the origin and development of home economics, with particular reference to its industrial, educational, and sociological aspects. *Twice a week; both semesters. One unit.* Professor BEVIER.

102. SPECIAL INVESTIGATIONS.—Problems in the application of the principles of bacteriology, chemistry, and physiology to the ordinary processes used in preparation of food; problems in nutrition. *Twice a week; both semesters. Two units.*

Professor BEVIER, Assistant Professor GOLDTHWAITE, Miss WHEELER.

Courses for Graduates and Advanced Undergraduates

4. FOOD AND NUTRITION.—An application of the principles of pure science to the problems of food and nutrition. The problems may be physiological, chemical or bacteriological. *Five times a week; first semester.*

Professor BEVIER, Assistant Professor GOLDTHWAITE, Miss WHEELER.

5. DIETETICS.—The work in dietetics includes the following topics: The principles of diet, the relation of food to health; influence of age, sex and occupation on diet; the construction of dietaries; dietetic treatment of certain diseases. *Three times a week; both semesters.*

Assistant Professor GOLDTHWAITE.

MATHEMATICS

Students entering upon graduate study in mathematics must have had a course in calculus extending through the

year, and a course in the theory of equations, or in differential equations. They should be able to read German and French.

Library Facilities.—The mathematical library of approximately 3,000 volumes, is in the seminar room. In addition to forty mathematical journals kept in the seminar room, the general University Library receives regularly about 2,400 periodicals, a considerable number of which are partly devoted to mathematics. These include the proceedings of various scientific societies such as: Les Comptes Rendus de l'Académie des Sciences (Paris); Sitzungsberichte der k. Akademie (Berlin); Nachrichten der Gesellschaft der Wissenschaften zu Göttingen; Transactions of the Royal Society (London); etc.

Models, Apparatus, etc.—The department has in its possession a collection of models for instruction and research in analysis, geometry, and kinematics. A considerable number of string models are available for demonstrating the properties of ruled surfaces and space curves; other models of wire and celluloid serve to make clear the peculiarities of space curves, in particular those of the third order. The collection also contains a number of kinematic models illustrating the generation of trochoids of various kinds, inversors, etc.

Courses for Graduates

100. SEMINAR. *Three times a week; both semesters. One to two units.* Professor TOWNSEND, Professor MILLER, Associate Professor RIETZ, Assistant Professor SISAM, Assistant Professor SHAW, Assistant Professor EMCH.

101. FUNCTIONS OF REAL VARIABLES.—An introduction to the theory of functions of real variables, making use of the general principles of the theory of assemblages. *Three times a week; both semesters. One unit.*

Professor TOWNSEND.

[Not given in 1914-15.]

104. EXPANSIONS IN FUNDAMENTAL FUNCTIONS.—This course develops the theory of integral equations far enough to arrive at methods of expansion of arbitrary functions in terms of the characteristic functions of a given nucleus. It includes applications of Green's functions, Potential functions, Fourier series, series of Legendrians, of

Bessel functions, and others; the study of differential equations of physics under given boundary conditions; the inversion of definite integrals. *Three times a week; both semesters. One unit.* Assistant Professor SHAW.

Prerequisite: Math. 16 or 22a.

[Not given in 1914-15.]

105. CALCULUS OF VARIATIONS.—A study of the necessary and sufficient conditions for a maximum or minimum in simple and isoperimetric problems. The methods of Weierstrass, Hilbert and Kneser are used and the subject matter illustrated by geometrical and physical problems, in particular to problems based on Hamilton's principle. *Three times a week; both semesters. One unit.*

106. GENERAL ANALYSIS.—

(a) Abstract Sets.—Power of a set; notion of limiting element; type of dimension; generalization Borel-Lebesgue theorem; continuous operations; various applications. *Twice a week; both semesters.*

Professor FRECHET.

(b) Functional Operations.—Stieltges' integral; functional definition of polynomials; linear operations; operations of order *n;* analytic operations; differentials of operations; functions of lines. *Twice a week; both semesters.*

Professor FRECHET.

110. ELLIPTIC FUNCTIONS.—The elements of the theory of elliptic functions with applications to geometry and mechanics. Introduction to the theory of the elliptic modular functions. *Three times a week; both semesters. One unit.*

Assistant Professor EMCH.

[Not given in 1914-15.]

111. AUTOMORPHIC FUNCTIONS.—The first semester will be devoted mostly to the group-theoretic side of the theory; the second semester will be concerned with the function-theoretic developments and applications. *Three times a week; both semesters. One unit.*

Assistant Professor EMCH.

[Not given in 1914-15.]

113. THEORY OF LINEAR DIFFERENTIAL EQUATIONS. *Three times a week; both semesters. One unit.*

Dr. CRATHORNE.

[Not given in 1914-15.]

120. Elementary Theory of Groups.—The study of the groups which present themselves in arithmetic, geometry, and trigonometry is followed by a determination and study of those which can be represented with a small number of letters. The latter part of the course is devoted to abstract root theory and the Galois theory of equations. *Three times a week; both semesters. One unit.*

Professor Miller.

121. Theory of Groups.—Second course. This course presupposes about one year's work in group-theory. The early part of the course is given to the consideration of recent advances and methods along these special lines, and the latter part to research. *Three times a week; both semesters. One unit.* Professor Miller.

[Not given in 1914-15.]

124. Theory of Numbers.—The principal subjects considered in this course are: congruences, Kronecker's modular systems, quadratic residues, quadratic forms and algebraic numbers. *Three times a week; both semesters. One unit.* Dr. Wahlin.

[Not given in 1914-15.]

129. Theory of Statistics.—The general methods of statistical investigation, the application of the theory of probability to statistical data, the fittting of curves to observation, interpolation, theory of errors, and the mathematical theory of variability and correlation, the application of the principles developed to problems in economics, sociology, and biology. *Three times a week; both semesters. One unit.* Professor Rietz.

[Not given in 1914-15.]

130. Invariants and Higher Plane Curves.—This course includes the general theory of algebraic curves, together with the application of the theory of invariants to higher plane curves. Special study is made of curves of the third and fourth order. *Three times a week; both semesters. One unit.* Assistant Professor Sisam.

[Not given in 1914-15.]

131. Algebraic Surfaces.—In this course are considered the application of homogenous coordinates and the theory of invariants to geometry of three dimensions, and

also the general theory of surfaces, together with the special properties of surfaces of the third and fourth order. *Three times a week; both semesters. One unit.*

Assistant Professor SISAM.

135. DIFFERENTIAL GEOMETRY.—Applications of the calculus to the general theory of curves and surfaces based primarily on the use of Cartesian coordinates. Relation of the theory of surfaces to the theory of invariants of a pair of quadratic differential forms. *Three times a week; both semesters. One unit.*

[Not given in 1914-15.]

141. VECTOR METHODS.—Principles of the algebras of quaternions, space analysis, and dyadics. Developments of theorems of differentiation and integration. Applications to rational mechanics, elasticity, hydrodynamics, electrodynamics. *Three times a week; both semesters. One unit.*

Assistant Professor SHAW.

Prerequisite: Math. 16.

[Not given in 1914-15.]

142. GENERAL ALGEBRA.—Theory of linear associative algebra or hypercomplex numbers, with particular study of the systems useful for the geometry and physics of N dimensions. Applications to relativity theories, and to general differential and integral invariants. Theory of linear operators and functional equations; applications to general analysis, integro-differential equations, infinite systems. General theory of operators; applications to general invariant theories. *Three times a week; both semesters. One unit.*

Assistant Professor SHAW.

Prerequisite: Math. 33.

Courses for Graduates and Advanced Undergraduates

7, 9. DIFFERENTIAL AND INTEGRAL CALCULUS.—The principles of the differential and integral calculus developed and applied to functions of one and of several variables. (Section A is an honor section and may be selected by those specializing in mathematics or having an average grade of 90 in freshman mathematics.) This course may be counted for graduate credit by students majoring in chemistry. *Five*

times a week, first semester; three times a week, second semester.

Professor Rietz, Assistant Professor Sisam, Assistant Professor Shaw, Assistant Professor Emch, Dr. Crathorne, Dr. Borger, Dr. Lytle, Dr. Wahlin, Dr. Stouffer, Dr. Kempner, Dr. Denton, Dr. Chittenden, Dr. Burns.

8. Differential and Integral Calculus.—(For students in chemistry and chemical engineering.) This course may be counted for graduate credit by students majoring in chemistry. *Five times a week; first semester.*

Professor Miller, Mr. Smith.

10. Theory of Equations and Determinants.—Some of the fundamental properties of an algebraic equation in one unknown; the solutions of systems of simultaneous equations; theory of a system of linear equations; some fundamental properties of determinants. May be counted for graduate credit by students majoring in other subjects than mathematics. *Three times a week; second semester.*

Professor Miller.

16. Differential Equations.—This course embraces the following topics: General linear equations with constant coefficients, special forms of differential equations of higher order, integration in series, etc. *Twice a week; first semester.* Professor Townsend.

19. Solid Analytical Geometry.—A general review of the equations of the plane and the right line in space and the more general properties of surfaces of the second degree. The classification and special properties of quadrics, and a brief introduction to the theory of surfaces in general. *Three times a week; second semester.*

Assistant Professor Sisam.

21. Method of Least Squares.—The fundamental principles of the subject. The following topics are studied: law of probability and error, adjustment of observation. precision of observations, independent and conditional observations, etc. *Twice a week; first semester.*

Professor Stebbins.

22. Partial Differential Equations.—This course deals with the integration and determination of the integra-

tion constants of such partial differential equations as arise in the study of such subjects as the flow of heat, the vibration of strings, plates, etc., and electricity. *Twice a week; second semester.* Professor TOWNSEND.

24. FUNCTIONS OF A COMPLEX VARIABLE.—A general introduction to the theory of function of a complex variable. *Three times a week; both semesters.*

Professor TOWNSEND.

27. PROJECTIVE GEOMETRY.—Fundamental concepts; anharmonic ratio; projective pencils and ranges; projective transformations and groups, theory of conics and quadric surfaces; pencils and ranges of conics; quadratic transformations and projective theory of cubics; application to mechanics. *Three times a week; both semesters.*

Dr. CRATHORNE.

31. ACTUARIAL THEORY.—The application of probability to life contingencies, the construction and graduation of mortality tables, the elements of fire insurance and the calculation of premiums and reserves for various types of insurance. *Three times a week; first semester.*

Professor RIETZ.

32. HISTORY OF MATHEMATICS.—A general view of the historical development of the elementary subjects and an outline of the rise and growth of the higher mathematics chiefly in the nineteenth century grouped about the persons most influential in this development. Lectures and reports on assigned reading. *Twice a week; second semester.*

Dr. LYTLE.

33. MODERN ALGEBRA.—This course includes a consideration of the following topics: theory of matrices; system of linear equations; bilinear and quadratic forms; properties of polynomials; algebraic invariants; and elementary divisors. *Three times a week; both semesters.* Dr. BORGER.

40. FUNDAMENTAL CONCEPTS OF MATHEMATICS.—Development of the number concept; concepts of unity; aggregate, order and correspondence; irrationals and limits, transcendence of e and n; parallel axiom and non-euclidian geometries; ruler and compass constructions; function; logic of mathematics. *Twice a week; second semester.*

Dr. LYTLE.

[Not given in 1914-15.]

PHYSICS

The prerequisite for graduate work in physics is a college course in general physics with a year's laboratory course in introductory physical measurements. The student who is to do major work in physics should also have had additional courses in physics or teaching experience, unless the training in his minor subjects, mathematics or chemistry, has been strong and complete. He should also have a knowledge of French and German sufficient to use references in these languages. The courses named below are those open for candidates for the master's or doctor's degree. In addition to these major graduate courses, the courses in elementary dynamics, heat, light, electrical measurements, and introductory electrical theory, are arranged with certain additions for graduate credit. Some of the "intermediate" courses on heat, light, and electricity and magnetism, may be offered by students making a minor in physics.

Courses for Graduates

121. Recent Advances in Physical Science.—Lectures illustrated by experiments on the more recent developments of physics. Students regularly registered in this course are required to make written reports, giving an original discussion of one or more of the topics discussed during the semester. *Once a week; first semester. Half unit.* Assistant Professor Knipp.

[Not given in 1914-15.]

123. Sound.—Lectures and recitations. Rayleigh's *Sound,* Auerbach's *Akustik* and Barton's *Sound* are used as reference texts. *Twice a week; both semesters. One unit.* Assistant Professor Watson.

124. Conduction of Electricity Through Gases.—Laboratory problems with readings and discussions on the electrical conductivity of gases, ions and ionisation, the effect of a magnetic field, the motion of ions, spark discharge, cathode rays, Roentgen rays, canal or positive rays, and related phenomena of radioactivity. *Three times a week; both semesters. One to two units.*

Assistant Professor Knipp.

126. Physics Colloquium.—Weekly meetings of the instructors and advanced students of the department for the presentation and discussion of papers on current problems in physics. Many of these papers are on investigations in progress in the laboratory, and experimental demonstrations are used. Attendance at this colloquium is expected of all the graduate students, though it is not registered, except in the cases of those making special reports on original investigations. *Once a week; both semesters. One-quarter to one-half unit.*

127a. Electron Theory.—Mathematical part. Application of Maxwell's equations to moving electrons, electrons in a magnetic field, resonance of electrons, theory of relativity and electromagnetic emission theory of light, theory of magnetism, electrons and quanta of energy, constitution of the atom, the electron theory of dispersion, the photoelectric effect, and Roentgen and secondary radiations form the subjects of this course, which has the character of a seminar. The current literature of the physical journals will be used. *Twice a week; both semesters. One unit.*

Assistant Professor Kunz.

127b. Electron Theory.—Physical part. The method of physical intuition will be used throughout this course, avoiding harder mathematical analysis; it is hoped that the course will be of special interest to students in chemistry. The phenomena of cathode rays, canal rays, Roentgen rays, of Zeeman, the chemical action of electrons and Roentgen rays, the conduction of electricity through gases, and absorption spectra, and the constitution of the atom will form the subjects of this course. *Three times a week; second semester. One unit.* Assistant Professor Kunz.

131. Investigation of Special Problems.—An advanced course in laboratory or in design and calculation. A problem is chosen and worked out with the advice and direction of the instructor. *Two to four times a week; both semesters. One to two units.*

Professor Carman, Assistant Professors Knipp, Watson, Schulz, Kunz, and Dr. Williams.

132. Mathematical Physics.—Special phases in theoretical physics.

(a) DYNAMICS.—First part: dynamics of a material system, determination of the center of gravity, moment of inertia and potential, potential theory, with applications in celectial mechanics. Second part: the principle of least action. Lagrange's equations, the theory of the top and its applications. The fundamental equations of elasticity, hydrodynamics, of the electromagnetic field and the second principle of thermodynamics for reversible processes will be deduced from the principle of least action. *Three times a week; both semesters. One to one and one-half units.*

Assistant Professor KUNZ.

(b) ELECTRODYNAMICS.—Lectures and collateral reading on the principles of electrodynamics. This course is continued in course 132d.

(c) THERMODYNAMICS, KINETIC THEORY OF GASES AND THEORY OF RADIATION.—Fundamental principles with application to physical and chemical phenomena and the kinetic theory of gases are treated in the first part. In the second part the theories of the equipartition of energy, the relation between probability and entropy, the theory of radiation of the black body and its new application in the photoelectric effect and in the specific heat will be studied with references to the current literature and the present fundamental problems of physics. *Four times a week; both semesters. Two units.* Assistant Professor KUNZ.

(d) THEORY OF ELECTRICAL OSCILLATIONS AND CYLINDRICAL HARMONICS.—The conduction of heat and electricity through cylinders and cables leads to the introduction of cylindrical harmonics of real arguments. Their mathematical properties will be studied. Electrical oscillations along parallel wires, the vibrations from a Wertz oscillator and from antenna, the propagation of electrical waves over the surface of the earth and their absorption will be studied in the first part of the course. Cylindrical and spherical harmonies will then be used for the solution of special problems, such as the resistance and self induction of wires. Applications of cylindrical harmonies will finally be made for phenomena in optics and radiation of light and heat. *Four times a week; both semesters. One to two units.* Assistant Professor KUNZ.

[Not given in 1914-15.]

133. SEMINAR. *Three or five times a week; both semesters. One to three units.*

Professor CARMAN, Assistant Professors KNIPP, WATSON, SCHULZ, KUNZ.

Courses for Graduates and Advanced Undergraduates

4. ELECTRICAL AND MAGNETIC MEASUREMENTS.—Laboratory exercises with discussions and recitations. The course extends throughout the year. It is intended primarily for students in electrical engineering, and is recommended to those wishing a comprehensive course in exact electrical measurements. *Twice a week; both semesters.*

Assistant Professor KNIPP, Mr. RANDOLPH, Mr. NATHANSON.

14. DYNAMICS AND ADVANCED GENERAL PHYSICS.—An introduction to theoretical physics involving the use of the calculus. The first semester is devoted to dynamics with an introduction to the mechanical theory of heat. *Three times a week; first semester.* Professor CARMAN.

20a. LIGHT.—Special phenomena; modern theories; reading in texts of Drude, Wood and Preston. Lectures; recitations. *Twice a week; first or second semester.*

Assistant Professor SCHULZ.

20b. LIGHT.—Light measurements. Laboratory. *Two to five times a week; first or second semester.*

Assistant Professor SCHULZ.

23. SOUND.—Lectures, recitations and laboratory experiments on the fundamental phenomena of acoustics. Text-Book: Barton's *Text-Book of Sound,* with additional references. *Three times a week; second semester.*

Assistant Professor WATSON.

25. HEAT—HIGH TEMPERATURE MEASUREMENTS.—The theory of the thermo-couple, the resistance thermometer, the various optical and radiation pyrometers, with laboratory experiments. Burgess' *High Temperature Measurements* will be used as a text, with additional references. *Twice a week; second semester.*

Assistant Professor WATSON.

28. HISTORY OF PHYSICS.—Lectures on the leaders in physics from Galileo to J. J. Thomson, with a discussion of

their contributions to the development of physics. Written reports on assigned readings are required. *Once a week; second semester.* Professor CARMAN.

30a. INTRODUCTION TO THEORETICAL ELECTRICITY.—A course of lectures and recitations discussing the phenomena with elementary calculus methods, and with occasional lecture-room demonstrations. References: Foster and Porter's *Electricity and Magnetism,* Thomson's *Elements of the Mathematical Theory of Electricity and Magnetism,* and Starling's *Electricity and Magnetism. Three times a week; second semester.* Assistant Professor KNIPP.

30b. ELECTRICITY AND MAGNETISM.—(1.) A course in electrical measurements with discussions primarily intended for students in physical chemistry, in which particular attention is given to galvanometers, resistance of metals and electrolytes, platinum resistance thermometers, thermocouples, dielectric constants of solids and liquids, electrometers, and work with the potentiometer. *Two times a week; first semester.* Assistant Professor KNIPP.

30b. ELECTRICITY AND MAGNETISM.—(2.) A course in electrical measurements including qualitative and quantitative experiments in the conduction of electricity through gases; also measurements of self and mutual induction, standardization and calibration work, problems in magnetism, etc. *Two, three or five times a week; second semester.* Assistant Professor KNIPP and Dr. WILLIAMS.

31. SPECIAL PROBLEMS IN ADVANCED PHYSICAL MEASUREMENTS. *Two or three times a week.*
Professor CARMAN, Assistant Professors KNIPP, WATSON, SCHULZ and Dr. WILLIAMS.

PHYSIOLOGY

The prerequisite for graduate work in Physiology is two years' work in chemistry and two in biology. The biology should include at least one year in the fundamentals of zoology and embryology.

Courses for Graduates

103. RESEARCH.—Facilities are offered in the physio-

logical laboratory for special lines of inevstigation. *Once a week; both semesters. One or two units.*

Assistant Professor BURGE.

Courses for Graduates and Advanced Undergraduates

1. HISTOLOGY.—This course includes a study of the fundamental mammalian tissues, and the microscopic anatomy of the organs. Lectures and laboratory. *Five times a week; first semester.*

Assistant Professor BURGE and Dr. BEARD.

2. PHYSIOLOGY.—This course includes a study of the physiology of nerve and muscle, circulation, respiration, secretion, digestion and metabolism. Lectures and laboratory. *Five times a week; second semester.*

Assistant Professor BURGE and Dr. BEARD.

5. SPECIAL PHYSIOLOGY.—This course includes work in the physiology of special sense, optics and advanced work in circulation, blood and respiration. Lectures and laboratory. *Five times a week; both semesters.*

Assistant Professor BURGE.

7. JOURNAL CLUB. *Once a week; both semesters.*

Assistant Professor BURGE.

ZOOLOGY

Two years of college work in zoology making a total of, at least, sixteen semester hours, are the requirements for entering upon major graduate study in this subject. Under special circumstances advanced work in closely allied subjects may be accepted in lieu of the fourth semester's work in zoology. When zoology is chosen for a minor the courses listed for graduates and undergraduates must be preceded by at least one full year's undergraduate work in zoology.

For the prosecution of graduate study in zoology a reading knowledge of German and French is indispensable and familiarity with Latin and Greek is of great advantage.

Every candidate for the doctor's degree is expected to acquire familiarity with the entire field of zoology, and, though his thesis is written on a restricted topic, the preliminary and final examinations will cover the subject as a whole.

Every candidate for the doctor's degree is expected to spend at least one summer in study at the seashore. To facilitate this plan an investigator's room has been provided at the Woods Hole Marine Biological Laboratory, where members of the department are afforded research facilities without cost to themselves. Application for the use of this room should be made to the head of the department early in the year.

The University Museum contains extensive collections of the representative forms of animal life and almost complete series of various groups in the fauna of Illinois. With the approval of the Director, the collections of the State Laboratory of Natural History are available for study and investigation by graduate students under appropriate conditions. The department has secured valuable collections of marine material from Plymouth, England, and Naples, Italy.

Separate research laboratories are provided for the exclusive use of graduate students and are equipped with special apparatus and demonstration material in accordance with their particular needs.

The University Library has grown rapidly and now contains not only current numbers but full series of a large number of foreign journals and publications of learned societies as well as the strictly biological and zoological periodicals, including all the leading American and foreign journals. The library of the State Laboratory of Natural History affords free access to a large and unusually complete collection of books on fresh water life, entomology, and economic zoology. The private library and collections of the head of the department, including several thousand books and pamphlets, mostly on invertebrate morphology and on parasitism, are shelved in the research laboratory and are available for the graduate students in zoology.

Courses for Graduates

102. SELECTED TOPICS, VERTEBRATE MORPHOLOGY.—Two lectures a week and required reading. *First semester. Half unit.* Professor KINGSLEY.

107. PARASITOLOGY.—The structure and life history of animal parasites, together with their relations to disease.

Conferences and assigned reading with laboratory demonstrations. *Two or three times a week; both semesters. One unit.* Professor WARD.

[Given in 1914-15 and in alternate years.]

113. EXPERIMENTAL ZOOLOGY.—Assigned problems in experimental embryology, regeneration, variation and heredity. The problems are individual and their scope is more or less extended to suit individual needs. *Two to five times a week; both semesters. One to two units.*

Associate Professor ZELENY.

117. FAUNISTIC ZOOLOGY.—Problems in taxonomy, distribution and ecology, accompanied by field work, conference and lectures. The work on some of these problems is greatly aided by the collections and library of the Illinois State Laboratory of Natural History. *Twice a week; both semesters. One to two units.*

Professor SMITH, Dr. ADAMS.

127. THEORIES OF ANIMAL PHYLOGENY.—Relations of various groups of animals; signification of so-called intermediate forms; study of invertebrate larval forms and of theories of descent based on them. Lectures; assigned readings; laboratory. *Once or twice a week; both semesters. One unit.* Professor WARD.

[Given in 1913-14 and alternate years.]

121. INDIVIDUAL RESEARCH COURSES.—

(a) Zoological problems. Professor WARD.
(b) Faunistic and systematic Zoology. Professor SMITH.
(c) Animal Ecology and Zoogeography. Dr. ADAMS.
(d) Vertebrate Morphology. Professor KINGSLEY.
(e) Experimental Zoology. Associate Professor ZELENY.

Courses for Graduates and Advanced Undergraduates

3. MICROSCOPICAL TECHNIQUE AND GENERAL VERTEBRATE EMBRYOLOGY.—Theory and practice of microscopical technique, followed by the study of vertebrate embryos in early stages of development. In the laboratory the student is first trained in the ordinary methods of fixation, embedding, section cutting, staining and mounting. Embryological

material will be prepared and used later in connection with the study of introductory embryology which completes the course. *Three times a week; first semester.*

Professor KINGSLEY.

6. VERTEBRATE ORGANOGENY. — A continuation of Course 3 intended for medical students and others who desire an intimate acquaintance with the development of the organs of the vertebrate body. The course includes lectures, assigned readings in a text-book of human embryology and laboratory studies on embryos of the chick and pig. *Three times a week; second semester.*

Professor KINGSLEY.

9. ANIMAL ECOLOGY.—Introductory study on the relation of animals to their natural environment. Special stress is laid upon the processes of change in environment and their influences upon animal life. Field trips are made for a study of the conditions under which the local fauna lives, and for instruction in methods of observations and the making of notes and collections. In the laboratory the specimens are collected and observed and determined, reports are prepared, and a working knowledge of the literature is acquired. Principal attention is given to insects, mollusks, reptiles, amphibians, and fishes. *Three times a week; second semester.* Dr. ADAMS.

11. PRINCIPLES OF ZOOGEOGRAPHY.—An introduction to the study of the geographical distribution of animals, in which particular attention is given to the faunae of North America and of Illinois. The fauna is considered in its relation to the complete environment—climate, physiography, geology, vegetation, etc.,—and from the standpoint of its origin and its dynamic relations. Laboratory work on maps, and field excursions. *Two or three times a week;* Saturday excursions to be arranged; *first semester.* Dr. ADAMS.

13. EXPERIMENTAL EMBRYOLOGY, REGENERATION.—An analysis of the factors concerned in individual development. Lectures and demonstrations. *Twice a week; first semester.*

Associate Professor ZELENY.

13a. EXPERIMENTAL EMBRYOLOGY, REGENERATION.—(Laboratory.) The application of the experimental method to a definite problem in embryology or regeneration. The

work will be individual. *Two to five times a week; both semesters.* Associate Professor ZELENY.

15. VARIATION AND HEREDITY.—An analysis of the fact of variation and heredity with reference (a) to the factors of organic evolution and (b) to the principles of animal breeding. Lectures and demonstrations. *Twice a week; second semester.* Associate Professor ZELENY.

15a. VARIATION AND HEREDITY.—(Laboratory.) The application of the experimental method to a definite problem in variation or heredity. The work will be individual. *Two to five times a week; both semesters.* Associate Professor ZELENY.

17. FIELD ZOOLOGY.—An acquaintance with common representatives of the lower vertebrates and of the various groups of land and fresh-water invertebrates (excluding insects) is acquired by the actual collection, preservation, and identification of those found in the vicinity together with identification work on living and preserved material from some of the larger rivers and lakes. Observations on the habits and life histories of selected forms. Field and laboratory work with assigned reading. *Four times a week; first semester.* Professor SMITH.

18. ADVANCED FIELD ZOOLOGY.—A continuation of Zoology 17, providing an opportunity for intensive work on more restricted problems in connection with the local fauna. The work may be introductory to subsequent investigation in this field. *Three to five times a week; second semester.* Professor SMITH.

20. CURRENT LITERATURE.—The instructors and advanced students of the department meet as a journal club for the presentation and discussion of the results of recent zoological investigation. All students doing major work in zoology are expected to take active part. *Once a week; both semesters.* Associate Professor ZELENY.

21. INTRODUCTION TO ZOOLOGICAL RESEARCH.—Students looking forward to independent investigation will be assigned definite topics, usually repeating the work of earlier investigators and will be directed in working out the morphology, life history, or reciprocal relations of invertebrate

forms. Laboratory work with stated conferences and assigned reading. *Two to five times a week; both semesters.*
Professor WARD.

22. ADVANCED MORPHOLOGY OF VERTEBRATES.—Laboratory work on the different classes of vertebrates, including careful dissection of a series of forms, detailed study of the skeleton, brain, and cranial nerves, and the morphology of the eye and ear. The work will involve considerable reading and will be accompanied by occasional lectures. *Two to five times a week; both semesters.*
Professor KINGSLEY.

29. ADVANCED ANIMAL ECOLOGY.—A study of special problems in ecology, distribution and faunae, with reference to the interpretations of the relation between animals and their environments. Conferences, laboratory and field work. *Two to five times a week; both semesters.*
Dr. ADAMS.

E. Engineering

The degree of Doctor of Philosophy in Engineering is offered in certain lines of academic graduate work of a high scholastic type in engineering science that will attract students who wish to prepare themselves as teachers, investigators and experts.

The general requirements for this degree, as to preliminary education, linguistic attainments, etc., are the same as in other lines.

The following lines of engineering science are open as majors for the present:

Engineering mechanics
Hydraulic and sanitary engineering
Steam engineering
Electrical engineering
Heating and ventilation engineering
Railway engineering
Masonry and structural engineering

The first minor must be one of the following fundamental sciences or an authorized combination of two of them:

Theoretical mechanics
Mathematics
Thermodynamics

Chemistry
Physics (Experimental or mathematical)
Zoology
Botany

The second minor should be in other than engineering subjects.

ARCHITECTURE

Registration in graduate courses in architecture presupposes full undergraduate work in the subject or group of subjects chosen.

Courses for Graduates

101. ARCHITECTURAL CONSTRUCTION.—Design of special structures. *Two to six times a week; both semesters. One-half to one unit.*

Professors RICKER and PROVINE.

102. SANITATION OF BUILDINGS.—The planning of sanitation, warming, and ventilation for buildings of importance. *Two or three times a week; first or second semester. One-quarter to one-half unit.*

103. ADVANCED ARCHITECTURAL GRAPHICS.—Advanced work in graphic statics, stereotomy, perspective, water color, and freehand drawing. *Two or three times a week; first or second semester. One-half to two units.*

Professors RICKER and PROVINE.

104. ARCHITECTURAL DESIGN.—Advanced architectural design. *Two to six times a week; first and second semesters. One to four units.* Assistant Professor ASH.

105. ARCHITECTURAL PRACTICE.—Contracts, specifications, and office methods. A study of architectural jurisprudence. *Two or three times a week; first or second semester. One-quarter to one-half unit.*

Professor PROVINE.

106. ARCHITECTURAL HISTORY.—Research on special topics, such as: Sources and evolution of architectural forms; origin, development and geographical distribution of architectural styles; effects of function on architectural forms; bibliographical and chronological research. *Two to six times a week; first or second semester. One-half to two units.* Professor RICKER.

CIVIL ENGINEERING

Registration in graduate courses in civil engineering presupposes full undergraduate work in the subject or group of subjects chosen.

Courses for Graduates

106. Reinforced Concrete Design.—A study of specifications for reinforced-concrete design in the light of modern tests. The design of concrete forms. The design of typical reinforced-concrete structures. Methods and costs of reinforced-concrete construction. *Twice a week; both semesters. One and one-half units or more.*

Assistant Professor McDaniel.

107. Bridge Engineering.—Theory of deflections; the general problem of the statically indeterminate frame, applications to swing bridges and arches; special graphical methods; theory of suspension bridges; secondary stresses; impact. *Two or three times a week; both semesters. One unit or more.* Assistant Professor Parcel.

124. Steel Building Construction.—The design of steel framing of fireproof office buildings, hotels, and industrial buildings; theory of wind bracing; long columns; eccentrically loaded columns; eccentric connections; analysis of special details; erection methods and costs. *Three times a week; both semesters. One unit or more.* Mr. Wilson.

ELECTRICAL ENGINEERING

Registration in graduate courses in electrical engineering presupposes full undergraduate work in the subject or group of subjects chosen.

Courses for Graduates

101. Advanced Course in Alternating Currents.—A study of polyphase circuits, alternating current machinery, alternating current measuring apparatus, or a combination of these subjects. *Twice a week; both semesters. One and one-half units.* Associate Professor Paine.

103. Electrical Design.—The development of plans for an electrical machine or apparatus of special character, or for the arrangement of an electrical plant, or for the in-

stallation of such machinery or apparatus. *Twice a week; second semester. One unit.* Assistant Professor WALDO.

104. TELEGRAPHY AND TELEPHONY. *Twice a week; second semester. One unit.*
Professor BROOKS, Associate Professor PAINE.

105. ELECTRICAL ENGINEERING RESEARCH.—An experimental investigation of some electrical phenomena, or tests of some electrical machine, or of a plant of such machines. *Twice a week; both semesters. One to three units.*
Assistant Professor BRYANT.

106. ILLUMINATION. *Once a week; both semesters. One unit.* Professor BROOKS, Assistant Professor BRYANT.

Courses for Graduates and Advanced Undergraduates

14. ALTERNATING CURRENTS. *Four times a week; first semester.*
Associate Professor PAINE, and Assistant Professor BRYANT.

17. ADVANCED ALTERNATING CURRENTS. *Four times a week; second semester.*
Associate Professor PAINE and Assistant Professor BRYANT.

27. ELECTRICAL ENGINEERING LABORATORY. *Twice a week; second semester.* Assistant Professor BRYANT.

MECHANICAL ENGINEERING

Registration in graduate courses in mechanical engineering presupposes full undergraduate work in the subject or group of subjects chosen.

Courses for Graduates

106. HEAT MOTORS.—The advanced theory of the internal combustion motor, and of the steam turbine; the general principles and methods of refrigeration. *Twice a week; second semester. One unit.*
Professor GOODENOUGH.

107. THERMODYNAMICS.—The general principles of thermodynamics and their application to the solution of engineering problems. *Twice a week; first semester. One unit.* Professor GOODENOUGH.

109. Machine Design.—The general principles of rational design; the application of mechanics of materials. Individual problems. *Twice a week; either semester. One unit.* Professor Leutwiler.

112. Laboratory Investigations.—Special investigations of problems relating to the combustion of fuels; boiler economy; steam engines and turbines; gas engines and producers; properties of explosion mixtures; mechanical refrigeration. Original work. *Three times a week; both semesters. One and one-half units.*

Professor Richards, Professor Harding.

114. Dynamics of Machinery.—Advanced problems; whirling and vibration of shafts; theory of governors; fly wheels; force and mass reduction; stresses in rotating masses. *Twice a week; both semesters. One unit.*

Professor Goodenough.

Courses for Graduates and Advanced Undergraduates

The following are acceptable as minor courses for students who are not candidates for advanced degrees in mechanical engineering:

6. Heat Engines.—The steam engine; steam turbine; gas engine; air compressor; refrigerating machine. Mixture of gases; combustion of gaseous fuels. (A continuation of course 7.) *Twice a week; both semesters.*

Professor Richards, Professor Goodenough.

7. Thermodynamics.—The transformation of heat into work; the second law and its connection with irreversible processes, the properties of heat media, the perfect gases, saturated and superheated vapors; the flow of fluids. *Three times a week; second semester.* Professor Goodenough.

8. Mechanics of Machinery.—Friction in machine parts; useful application of friction as in friction clutches and brakes; transmission of power by ropes and belting; brakes, clutches and dynamometers; hoisting machinery; hoisting in mines; elevators and cranes; hydraulic machinery; accumulators, and centrifugal pumps; fans, blowers, air compressors, air motors and transmission of power by means of air. *Three times a week; first semester.*

Assistant Professor Leutwiler.

9. Machine Design.—Theory of machine design, with applications; investigation of actual machines similar to the one to be designed; design of machinery subjected to heavy and variable stresses; punches, shears, presses, rivets, and cranes. *Three times a week; both semesters.*
Assistant Professor Leutwiler.

12. Mechanical Engineering Laboratory.—Experiments on engines, turbines, gas engines, pumps, boilers, injectors, air compressors, hoisting appliances, heating apparatus, and refrigerating machines. Tests of power plants in the vicinity. *Three times a week; first semester.*

MECHANICS, THEORETICAL AND APPLIED

Registration in graduate courses in theoretical and applied mechanics presupposes full undergraduate work in the subject or group of subjects chosen.

Courses for Graduates

101. Analytical Mechanics.—The fundamental premises of mechanics; methods of treatment and attack; the more complex problems and applications; a critical and comparative study of texts. *Twice a week; first semester. One unit.* Assistant Professor Moore.

102. Resistance of Materials.—Advanced work on the properties of materials used in engineering construction and the methods of determining these properties; analysis and investigation in mechanics of materials, including the effect of form of member in a structure or machine and the method of application of forces. Comparative study of texts may be made. *Twice a week; second semester. One unit.* Assistant Professor Moore.

103. Hydraulics and Hydraulic Engineering.—The laws of hydraulics and their application to engineering problems; hydraulic power and its development; design and investigation. *Twice a week; second semester. One unit.*
Professor Talbot, Assistant Professor Moore.

104. Experimental Work in Laboratory of Applied Mechanics.—(a) Laboratory investigation in the materials testing laboratory on materials and on their action as used

in machines and structures; (b) experimental work in hydraulic laboratory with pumps, motors, and measuring devices, and the investigation of the laws of hydraulics, the development of power, and the study of various hydraulic problems. *Twice a week; both semesters. One-half to two units.* Professor TALBOT, Assistant Professor MOORE.

105. EXPERIMENTAL AND ANALYTICAL WORK IN REINFORCED CONCRETE.—Research work in reinforced concrete. The interpretation of available experimental results and their application to the design of structure. The principles of construction and a study of typical reinforced concrete structures. *Twice a week; both semesters. One and one-half units or more.* Professor TALBOT.

MINING ENGINEERING

Registration in graduate courses in mining engineering presupposes full undergraduate work in the subject or group of subjects chosen.

The laboratory connected with the extended investigation of mining conditions in Illinois now being carried on by the Department of Mining Engineering, the State Geological Survey and the United States Bureau of Mines, together with the Mine Rescue Station operated by the same parties, are available for graduate instruction in addition to the regular University laboratories, for coal washing, ore dressing, blasting and explosives and mine ventilation.

Courses for Graduates

101. ADVANCED MINING METHODS.—Including a study of the coal and ore fields of the United States, methods of mining, and the economics of mining, including the utilization, marketing, storage and transportation of coal and ores. *Twice a week; both semesters. One unit.*

Professor STOEK.

102. ADVANCED PREPARATION OF COAL AND ORES.—Detailed investigation and discussion of settling ratios, laws of crushing, sorting vs. sizing, etc., specific mill and washery problems. *Twice a week; both semesters. One unit.*

Assistant Professor HOLBROOK.

Courses for Graduates and Advanced Undergraduates

5. Mine Ventilation and Mine Gases.
Professor Stoek.

9. Preparation of Coal and Ores.
Assistant Professor Holbrook.

MUNICIPAL AND SANITARY ENGINEERING

Entrance upon graduate work in municipal and sanitary engineering presupposes a full undergraduate course in that subject.

Courses for Graduates

102. Water Supply Engineering.—Advanced work in water supply engineering will be arranged to fit the conditions of individual classes. Sources and requirements of water supply, general water works construction, pumps and pumping, design of reservoirs and elevated tanks, and water works operation and the valuation of plants are among the topics which may be treated. *One to three times a week; first or second semester. One unit.*
Professor Talbot.

103. Sewerage.—General sewerage design and construction, a study of sewerage systems, hydraulics of sewers, and a study of run-off, are examples of the work which may be taken up. *Once or twice a week; second semester. One unit.* Professor Talbot.

106. Water Purification, Sewage Disposal and General Sanitation.—The design, construction, and operation of water purification plants and of sewage disposal works, the study of existing plants, and the comparison of results and cost of construction and operation may be taken up in this course. Experimental work on water filters, septic tanks, etc., may be included. Garbage disposal and general sanitation may also be taken up. *Once a week; second semester. Half unit.* Professor Talbot.

RAILWAY ENGINEERING

Registration in graduate courses in railway engineering presupposes full undergraduate work in the subject or group of subjects chosen.

The equipment of the department of railway engineering includes a modern laboratory for testing locomotives, a dynamometer car designed for train resistance and locomotive tests on steam roads, and an electric test-car for similar work on electric lines. The department owns also a drop testing machine and a brakeshoe testing machine, which conform, in their design, to the standards of the Master Car Builders' Association.

Courses for Graduates

102. LOCOMOTIVE DESIGN.—Study and analysis of modern practice concerning steam pressure, compounding, superheating, etc. The work in this course may be arranged to suit special requirements of the individual student. *Once a week; both semesters. One unit.*

Professor Goss.

106. LOCOMOTIVE OPERATION.—Study and determination of train resistance and locomotive tractive effort. The application of these and other matters in the establishment of tonnage ratings. *Once a week; both semesters. One unit.* Professor SCHMIDT.

108. ELECTRIC RAILWAYS.—This course deals with the design, selection, and operation of electric railway equipment. Central station, sub-station, rolling stock, and line equipment are considered. The emphasis is put upon either design or operation according to the training and purpose of the student. *Once a week; both semesters. One unit.*

Assistant Professor BUCK.

110. RAILWAY LOCATION.—This course is essentially a study of the effects of the location of a railway upon its earning capacity. It deals with the engineering and economic problems met with in original location, as well as in the relocation and reduction of grades of existing lines. *Once a week; both semesters. One unit.* Mr. COMSTOCK.

Courses for Graduates and Advanced Undergraduates

4. LOCOMOTIVE PERFORMANCE. *Twice a week; first semester.* Professor SCHMIDT.

33. ECONOMIC THEORY OF RAILWAY LOCATION. *Four times a week; first semester.* Mr. COMSTOCK.

64. Electric Railway Practice. *Three times a week; first semester.* Assistant Professor Buck.

65. Electric Railway Practice. *Three times a week; second semester.* Assistant Professor Buck.

F. Agriculture

AGRONOMY

Students who wish to do their major work in agronomy must have had the major courses offered in that subject to undergraduates in the College of Agriculture of the University of Illinois, or the equivalent. While every one seeking a doctor's degree with agronomy as a major will be required to have a good knowledge of the whole field of agronomy, each student is expected to be especially prepared in some one of the following divisions of the field: soil fertility, plant breeding, soil physics, crop production and soil biology.

Students who are taking their major work in other departments and choose agronomy as a minor, must have had previously the work in chemistry, botany and other fundamental sciences prescribed for the undergraduate courses in agronomy in the College of Agriculture, or the equivalent.

Courses for Graduates

101. Soil Investigation.—A study of systems of soil investigation; sources of error and methods of control; interpretation of results. *Once a week; second semester. One unit.* Professor Hopkins.

103. Soil History.—Different systems of agricultural practice and their ultimate effect upon the soil. *Once a week; second semester. One unit.* Professor Hopkins.

112. Plant Breeding.—This course includes a detailed study of the experiments at this station, and of methods and results reported from other states and from foreign countries. *Twice a week; both semesters. One to two units.* Professor Smith.

118. Investigation.—A special problem is chosen and worked out under the advice and direction of the instructor. *One to five times a week; both semesters. One to four units.*

Professors Hopkins, Smith, Mosier, Pettit, Dr. Whiting.

Courses for Graduates and Advanced Undergraduates

9. Soil Physics and Management.—Origin of soil material; methods of formation; mechanical composition and classification; moisture; texture as affecting capillarity, osmosis, diffusion, temperature, aeration, etc. *Five times a week; both semesters.* Professor Mosier.

11. Soil Biology.—Activities of infusoria, fungi, algae, and bacteria in soils from the standpoint of soil fertility; fermentation of crop residues and green and farm manures and its effect upon insoluble plant food; fixation of atmospheric nitrogen, its transformations, use, and possible losses. Lectures; laboratory. *Three times a week; second semester.* Professor Pettit, Dr. Whiting.

12. Soil Fertility, Fertilizers, Rotations.—The influence of fertility, natural or supplied, upon the yield of various crops; effect of different crops upon the soil and upon succeeding crops, etc. *Five times a week; second semester.* Professor Hopkins.

16. German Agricultural Readings.—The current numbers of German periodicals on agricultural science are required as a text. *Twice a week; second semester.* Professor Hopkins.

22. Plant Breeding.—The improvement by breeding of field crops, including the grains, grasses, and legumes; the principles and methods of selection with critical studies of results obtained by various investigators. Lectures, assigned readings, demonstrations, and laboratory exercises. *Twice a week; second semester.* Professor Smith.

23. Plant Food Supplies.—The world's supply of plant food materials, including methods of utilization. *Once a week; second semester.* Professor Pettit.

24. Mechanical Composition of Soils.—A study of the mechanical composition of the soil and its influence upon granulation, absorption and retention of moisture, and other physical properties affecting crop production. *Arrange time; first semester.* Professor Mosier.

ANIMAL HUSBANDRY

Students entering graduate work in animal husbandry must have had a thorough training in the fundamental

principles of the subject either in connection with or in addition to an agricultural course of study substantially equivalent to that offered in this University.

Courses for Graduates

103. Live Stock Experimentation.—Objects, methods and the sources of error in experimental work dealing with the feeding, breeding and management of farm animals. Critical study of live stock experiments at this and other experiment stations. *Once a week; both semesters. One-half to one and one-half units.*

Professor Davenport.

110. Animal Nutrition.—The course includes a thorough study of the chemical and physiological changes and processes involved in the activities of animal life. Special attention is given to a study of the most recent publications along the above lines. *Three times a week; both semesters. One unit.* Professor Grindley, Dr. Joseph.

111. Animal Nutrition.—A study of methods employed in the examination and analysis of feeding stuffs; also animal substances including flesh, fat, bone, urine, feces, and manufactured animal products. *Three to five times a week; both semesters. One to two units.*

Professor Grindley.

112. Investigation.—Opportunity is afforded to pursue investigations along the following lines:

(a) Economic Factors Involved in the Various Phases of Meat Production.

(b) Systems of Live Stock Farming.

(c) The Valuation of Pedigrees. *(a), (b) and (c), once a week; both semesters. One to two units.*

Professor Mumford.

(d) Animal Nutrition. A research course in animal nutrition including digestion and metabolism experiments and biochemical studies connected with the nutrition of farm animals. *Five times a week; both semesters. One to two units.* Professor Grindley, Dr. Joseph.

116. Seminar.—The subject of study for 1913-1914 was the food requirements for the growth and fattening of farm animals. *Arrange time; both semesters. Quarter unit.* Members of the Staff.

117. Genetics.—A study and criticism of the more important genetic experiments, the biological and mathematical methods employed, and the validity of the conclusions. *Three to five times a week; both semesters. One to two units.* Assistant Professor Detlefsen.

Courses for Graduates and Advanced Undergraduates

7. Principles of Animal Nutrition. *Five times a week; first semester.* Professor Grindley, Dr. Joseph.

22. Advanced Stock Judging.—A study of animal conformation with reference to market and show yard form; quality and condition. *Five times a week; first semester.* Various members of the department.

24. Meat.—A study of the influence of type, condition, age, sex and feeds upon the yield and market grade of meat products. *Once a week; second semester.* Assistant Professor Hall.

[Not given in 1914-15.]

25. Wool.—A study of the factors affecting the quality, quantity, strength, and condition of wool. *Once a week; second semester.* Professor Coffey.

[This course will be offered in alternate years, beginning with the second semester, 1915.]

26. Swine.—The factors of animal nutrition that have to do with the large and economical production of pork and the determination of type in swine. *Once a week; second semester. Half unit.*

[Not given in 1914-15.]

27. Sheep Husbandry.—Dealing with the factors determining the importance of the industry in leading sheep growing countries and particularly in different parts of the United States. *Arrange time; second semester.* Professor Coffey.

[This course will be offered in alternate years, beginning with the second semester, 1914.]

28. Advanced History of Breeds of Live Stock.—A study of the methods of prominent breeders, and the performances of great individual beef animals, horses, sheep and swine. *First semester.*

Professor Mumford and Other Members of the Department.

29. Systems of Live Stock Farming.—A study of the principles of farm management as applied to live stock farming. *Twice a week; second semester.*
Mr. Handschin.

30. Genetics.—The fundamental principles of heredity and variation. *Daily; second semester.*
Assistant Professor Detlefsen.

31. Principles of Animal Nutrition.—Continuation of 7. *Three to five times a week; both semesters.*
Professor Grindley, Dr. Joseph.

32. Marketing Live Stock.—A study of marketing and methods of marketing live stock and their products. *Twice a week; second semester.* Professor Mumford.

DAIRY HUSBANDRY

Students entering graduate work in dairy husbandry must have had a thorough training in the fundamental principles of the subject of their major or minor, substantially equivalent to that offered in this University.

Courses for Graduates

101. Economic Milk Production.—A study of differences in the efficiency of dairy cows, cause and effect of the same, and the relation they bear to successful dairy farming. *Twice a week; both semesters. One unit.*
Professor Fraser.

102. Research.—A study of the investigations in progress in the dairy herds of the State. *Both semesters. One unit.* Professor Fraser.

103. Research.—Dairy feeding problems. *Both semesters. One unit.* Professor Fraser.

104. Dairy Bacteriology.—Lecture and research on assigned topics. *Twice a week; both semesters. One unit.*
Professor Harding

Courses for Graduates and Advanced Undergraduates

7. Butter Making and Factory Management.—Cream receiving and ripening; pasteurization; use of commercial starters; churning; salting; working and market-

ing butter; butter scoring; separators; special problems for the manufacture of butter; private and co-operative management of creameries; centralizers' systems; creamery accounting and business methods; refrigerating; ice cream making; location and planning of creamery buildings. Lectures, assigned readings, and laboratory practice. *Second semester; six times a week.*

Assistant Professor HEPBURN, Mr. LANG.

11. DAIRY BACTERIOLOGY.—The relation of bacteria to the dairy industry; changes commonly effected in milk by bacteria; market milk; inspected milk; certified milk; pasteurized milk; bacteria characteristic of different groups; bacteria producing milk of unusual character; preserved milks; butter; oleomargarine; cheese. *Three times a week; second semester.* Professor HARDING, Mr. PARKER.

21. ECONOMIC MILK PRODUCTION. *Five times a week; second semester.* Professor FRASER, Mr. BRAND.

HORTICULTURE

At least two years of collegiate work in horticulture and allied subjects and the requisite preparation for the chosen topics are required for entrance upon major work in this department.

Courses for Graduates

102. POMOLOGY.—Special problems in the adaption, propagation, cultivation, or pruning of small fruits. *Both semesters. One to two units* Professor CRANDALL.

103. OLERICULTURE.—Special problems in the structure, cultural requirements, and improvements of vegetables. *Both semesters. One to two units.*

Professor LLOYD.

108. POMOLOGY.—Special problems in the relationship, adaption, improvement, propagation, cultivation, pruning, protection, preservation, or marketing of orchard fruits. *Both semesters. One to two units.*

Professor BLAIR, Professor CRANDALL.

109. FORESTRY.—Problems in general forestry and investigation of forest growths.

115. FLORICULTURE.—The horticultural status of var-

ious flowering plants, or special problems in the culture of greenhouse plants. *One to two units.*

Assistant Professor DORNER.

Courses for Graduates and Advanced Undergraduates

8. ORCHARDING.—A comprehensive study of pomaceous fruits (apple, pear, quince) and drupoceous or stone fruits (plum, cherry, peach, nectarine, apricot.) *Five times a week; first semester.* Professor CRANDALL.

12. EVOLUTION OF HORTICULTURAL PLANTS.—History, botanical classification, and geographical distribution of cultivated plants; modification under culture; theoretical causes and observed factors that influence variation, particularly food supply, climate and cross-fertilization. *Three times a week; first semester.* Professor CRANDALL.

18. EXPERIMENTAL HORTICULTURE.—Methods and difficulties in horticultural investigations; the planning of experiments; recording and interpretation of results. (For advanced students preparing for experiment station work.) *Five time a week; second semester.*

Professor BLAIR, Assistant Professor PICKETT, Mr. WATKINS.

INDEX

Admission, 9
Advisors, 10
Agronomy, 106
Animal Husbandry, 107
Architecture, 98
Astronomy, 62
Attendance, 10

Bacteriology, 62
Board of Trustees, 5
Botany, 63

Calendar, 1914-15, 6
Ceramics, 65
Character of graduate work, 12
Chemistry, 66
Civil Engineering, 99
Classics, 23
  Classical Philology, 27

Dairy Husbandry, 110
Degrees, 12
  Doctor's, 15
  Master's, 12
    Professional, in Engineering, 14
Diploma fee, 22
Dittenberger Classical Library, 20
Doctor's degree, 15
  In Classics, 23
  In English, 28

Economics, 40
Education, 55
Education Library (Aron Library), 21
Electrical Engineering, 99
Engineering, master's degree in, 13
  Architecture, 98
  Civil Engineering, 99
  Electrical Engineering, 99
  Mechanical Engineering, 100
  Mechanics, Theoretical and Applied, 102
  Mining Engineering, 103
  Municipal and Sanitary Engineering, 104
  Railway Engineering, 104
English, 27
  Literature and Language, 30
  Rhetoric, 31
Entomology, 75
Entrance requirements, 9, 10
Establishment of Graduate School, 9
Examinations for Doctor's degree, 16
Expenses, fees, 22

Faculty, Executive, 8
Fees, 22
Fellowships and scholarships, 18
  In Engineering, 19
French, 36

Geology, 77
German, 31
Germanic Languages, 31
Graduates of University, 9
  of other institutions, 9
Graduate assistants, 12
Graduate Club, 22
Greek, 23
Gröber Library, 21

Heyne Library, 20
History, 44
History of Graduate School, 9
Household Science, 80

Incidental fees, 22

Journalism, 31

Laboratory fees, 22
Latin, 24
Libraries, 20
  Aron, 21
  Dittenberger, 20
  Gröber, 21
  Heyne, 20
  Mason, 20
  Natural History, 20, 75, 93
  University, 20
  Vahlen, 21
Locomotive Testing Laboratory, 105

Mason Library, 20
Master of Arts, degree of, 12
  In Classics, 23
  In English, 27
Master of Science, degree of, 12
Master's degree in engineering, 13
Mathematics, 80
Matriculation fee, 22
Mechanical Engineering, 100
Mechanics, Theoretical and Applied, 102
Mining Engineering, 103
Municipal and Sanitary Engineering, 104

Natural History Library, 20

Philosophy, 59
Physics, 87
Pysiology, 91
Political Science, 50
Professional degrees in Engineering, 14
Psychology, 60

Railway Engineering, 104
Registration, 10
Research fellowships, Engineering Experiment Station, 19
Residence study, 12
Rhetoric, 31
Romance Languages, 36
  French, 36
  Gröber Library in, 21
  Spanish, 39
Rooms and board, 22

Scandinavian Languages, 34
Scholarships and fellowships, 18
Sociology, 53
Spanish, 39
State Entomologist's Office, 75
State Laboratory of Natural History, 75, 93

Theses, Doctor's, 17
Theses, Master's, 13
Trustees, Board of, 5

Vahlen Library, 21

Woods Hole Marine Laboratory, 93

Zoology, 92

gIIa
-16

ERSITY OF ILLINOIS BULLETIN
ISSUED WEEKLY
Vol. XII AUGUST 9, 1915 No. 49
Entered as second-class matter December 11, 1912, at the post office at Urbana, Illinois, under the Act of August 24, 1912.]

THE GRADUATE SCHOOL

Of The

UNIVERSITY OF ILLINOIS

1915-1916

PUBLISHED BY THE UNIVERSITY
URBANA, ILLINOIS

[Ed. Aug. 1, 5,000]

THE UNIVERSITY OF ILLINOIS

THE STATE UNIVERSITY

THE UNIVERSITY INCLUDES

THE GRADUATE SCHOOL, which offers courses of graduate study in all departments of the University.

THE COLLEGE OF LIBERAL ARTS AND SCIENCES.

THE COLLEGE OF ENGINEERING AND ENGINEERING EXPERIMENT STATION.

THE COLLEGE OF AGRICULTURE AND THE AGRICULTURAL EXPERIMENT STATION

THE COLLEGE OF COMMERCE AND BUSINESS ADMINISTRATION.

THE COLLEGE OF LAW (Three years' course).

THE COLLEGE OF MEDICINE (Chicago).

THE COLLEGE OF DENTISTRY (Chicago).

THE SCHOOLS OF EDUCATION, MUSIC, LIBRARY SCIENCE, AND PHARMACY (Chicago).

THE SUMMER SESSION of eight weeks, held each summer.

The State Laboratory of Natural History, the State Geological Survey, the State Water Survey, and the Mine Rescue Station, connected with the University, all offer unusual facilities for research.

The Libraries at Urbana contain 336,000 volumes and more than 78,000 pamphlets.

For catalogs and information address

THE UNIVERSITY REGISTRAR,
Urbana, Illinois

THE GRADUATE SCHOOL

Of The

UNIVERSITY OF ILLINOIS

Announcement For
1915-1916

PUBLISHED BY THE UNIVERSITY
URBANA, ILLINOIS

CONTENTS

PAGE

Board of Trustees 5
University Calendar 6
Executive Faculty 8
History and Organization 9
Admission 9
Registration 11
Residence 12
Character of Graduate Work 13
Master's Degrees 13
In Arts and Science 13
In Engineering 14
The Doctor's Degree 15
Period of Study 16
Examinations 16
Thesis 17
In Engineering 18
Scholarships and Fellowships 19
Research Engineering Fellowships 20
Libraries 20
Fees and Expenses 22
Graduate Club 23

DEPARTMENTS OF INSTRUCTION

Agronomy 23
Animal Husbandry 25
Architecture and Architectural Engineering 27
Astronomy 28
Bacteriology 28
Botany 29
Ceramic Engineering 30
Chemistry 32

PAGE

Civil Engineering 38
Classics 39
Greek 40
Latin 41
Classical Philology 42
Dairy Husbandry 43
Economics 44
Education 46
Electrical Engineering 48
English 49
Literature and Language 52
Rhetoric 53
Entomology 54
Geology 55
Germanic Languages and Literatures 57
The Scandinavian Languages 60
History 61
Horticulture 66
Household Science 67
Mathematics 68
Mechanical Engineering 72
Mechanics, Theoretical and Applied 73
Mining Engineering 75
Municipal and Sanitary Engineering 76
Philology 77
Philosophy 77
Physics 78
Physiology 82
Political Science 83
Psychology 86
Romance Languages and Literatures 87
French 87
Italian 89
Spanish 89
Sociology 90
Transportation 92
Engineering 92
Economic and Administrative 93
Zoology 93
Index 98

BOARD OF TRUSTEES

THE GOVERNOR OF ILLINOIS.....*Ex Officio*
EDWARD F. DUNNE.....Springfield
THE PRESIDENT OF THE STATE BOARD OF AGRICULTURE.....*Ex Officio*
LEN SMALL .....Kankakee
THE SUPERINTENDENT OF PUBLIC INSTRUCTION.....*Ex Officio*
FRANCIS G. BLAIR.....Springfield

	TERM EXPIRES
WILLIAM L. ABBOTT, 72 W. Adams Street, Chicago	1917
OTIS W. HOIT, Geneseo	1917
MARY E. BUSEY, Urbana	1917
ELLEN M. HENROTIN, 1656 N. LaSalle Ave., Chicago	1919
JOHN R. TREVETT, Champaign	1919
FLORENCE E. WATSON, Iola	1919
LAURA B. EVANS, Taylorville	1921
ROBERT F. CARR, Chicago	1921
ROBERT R. WARD, Benton	1921

OFFICERS OF THE BOARD

WILLIAM L. ABBOTT, 72 W. Adams Street, Chicago.....President
HARRISON E. CUNNINGHAM, Urbana.....Secretary
HAZEN S. CAPRON, Champaign.....Treasurer
W. B. CASTENHOLZ, Urbana.....Comptroller

THE UNIVERSITY CALENDAR
1915-1916

As Applicable to the Graduate School

FIRST SEMESTER, 1915-1916

1915

Sept. 20, 21, Monday, Tuesday	Registration days
Sept. 22, Wednesday, 8 a. m.	Instruction begun
Nov. 1, Monday, 5 p. m.	Latest day for announcement of subjects for graduate theses
Nov. 24, Wednesday, 12 m.	Thanksgiving recess begun
Nov. 29, Monday, 12 m.	Instruction resumed
Dec. 3, Friday	Illinois Day
Dec. 21, Tuesday, 5 p. m.	Holiday recess begun
Dec. 31, Friday, 5 p. m.	Latest day for submission of outlines of theses by candidates for professional degrees in engineering

1916

Jan. 3, Monday, 12 m.	Instruction resumed
Jan. 27, Thursday	Semester examinations begun
Feb. 3, Thursday	Semester examinations ended

SECOND SEMESTER, 1915-1916

Feb. 7, 8, Monday, Tuesday	Registration days
Feb. 9, Wednesday, 8 a. m.	Instruction begun
Feb. 12, Saturday	Lincoln Day
April 1, Saturday, 5 p. m.	Latest day for filing of completed theses by candidates for professional degrees in engineering
April 20, Thursday, 12 m.	Easter recess begun
April 25, Tuesday, 12 m.	Instruction resumed
May 13, Saturday, 12 m.	Latest day for receipt by the Dean of the Graduate School of certified copies of doctors' theses

June 1, Thursday, 8 a. m.	Semester examinations begun
June 3, Saturday, 12 m.	Latest day for receipt by the Dean of the Graduate School of certified copies of masters' theses
June 8, Thursday	Semester examinations ended
June 11, Sunday	Baccalaureate address
June 13, Tuesday	Alumni Day
June 14, Wednesday	Forty-fifth Annual Commencement

THE EXECUTIVE FACULTY

EDMUND JANES JAMES, PH.D., LL.D., PRESIDENT OF THE UNIVERSITY.

DAVID KINLEY, PH.D., LL.D., *Dean and Professor of Economics.*
BOYD HENRY BODE, PH.D., *Professor of Philosophy.*
ALBERT PRUDEN CARMAN, A.M., SC.D., *Professor of Physics.*
JULIUS GOEBEL, PH.D., *Professor of Germanic Languages.*
GEORGE ALFRED GOODENOUGH, M.E., *Professor of Thermodynamics.*
HARRY ALEXIS HARDING, PH.D., *Professor of Dairy Bacteriology.*
LAURENCE MARCELLUS LARSON, PH.D., *Professor of History.*
HERBERT WINDSOR MUMFORD, B.S., *Professor of Animal Husbandry.*
WILLIAM ABBOTT OLDFATHER, PH.D., *Professor of Classics. Secretary.*
STUART PRATT SHERMAN, PH.D., *Professor of English.*
ARTHUR NEWELL TALBOT, C.E., *Professor of Municipal and Sanitary Engineering.*
EDGAR JEROME TOWNSEND, PH.D., *Professor of Mathematics.*
HENRY BALDWIN WARD, PH.D., *Professor of Zoology.*
EDWARD WIGHT WASHBURN, PH.D., *Professor of Physical Chemistry.*

HISTORY AND ORGANIZATION

Although for many years the University of Illinois had offered advanced students facilities for study and research in various lines, graduate work was undertaken under the name of the Graduate School for the first time in 1892. In 1894 the administration of the school was vested in the Council of Administration, and the Vice-President of the University became Dean of the School. In 1906 the Graduate School was organized as a separate faculty, consisting of a dean and members of the University faculty assigned to this duty by the President.

By act of the Trustees the teaching faculty of the Graduate School includes all members of the University faculty who give instruction in approved graduate courses. The affairs of the School, however, are in charge of the executive faculty appointed each year by the President.

ADMISSION

Admission to the Graduate School may be granted to graduates of institutions whose requirements for the bachelor's degree are substantially equivalent to those of the University of Illinois, and to applicants from other institutions approved by the Executive Faculty, as hereinafter provided. *Admission to the Graduate School does not, however, imply admission to candidacy for an advanced degree.*

A graduate of an institution meeting the requirements of a standard college, as described below, may be admitted to the Graduate School, provided he satisfies the Dean and the departments concerned that he will be able to proceed to the master's degree in a period not exceeding two years.

For purposes of admission to the Graduate School a *standard college* is one which meets the following requirements:

a. The college shall require four years' work of collegiate grade for graduation, based upon an entrance requirement of at least fourteen standard high school units.

b. If conditioned students are admitted, they shall not be allowed to proceed beyond the sophomore year without removing their conditions.

c. The college shall maintain at least six departments in liberal arts and sciences, each having at least one professor in each department giving his entire time to the college work of his department.

d. The minimum educational attainment of college professors shall be equivalent to graduation from a college of high grade and graduate work equivalent at least to that required for a master's degree from the University of Illinois.

e. The college shall have a productive endowment sufficient to yield a net annual income of at least $10,000 available for instructional purposes in the college. If the institution offers courses in addition to the usual liberal arts course, it shall have a correspondingly larger annual income.

f. The college shall have library and laboratory equipment sufficient to meet fully the needs of the courses announced.

g. In addition to the foregoing specific requirements, so far as possible the general standing of the college shall be considered, including: the character of its curriculum, the efficiency of its instruction, the number of hours of instruction required of the members of its faculty, the size of the classes, the general standards for graduation, its conservatism in granting degrees based upon work done *in absentia,* the success of its graduates in the Graduate School of this University and elsewhere, etc.

Unless otherwise specially permitted, a student enrolled in the Graduate School must take each semester at least one course accepted by the executive faculty for credit in his major subject.

Admission to particular graduate courses or departments may be granted only to those who have had the requisite undergraduate work in those courses or departments. But a student of mature age who satisfies the Dean and the department concerned of his ability to pursue graduate work in a given line may be enrolled in particular graduate courses, and permitted to carry on such study or investigation under the direction of a department of the University as the department shall recommend and the executive faculty approve.

Application blanks may be secured from the Dean of the Graduate School or from the Registrar of the University.

REGISTRATION AND PROGRAM OF STUDY

After the student's application for admission has been approved, he receives at the Dean's office a permit to register and also a study blank. This study blank must be filled out with the advice of the professors in charge of the selected work.

Advisers.—The person in charge of the major work of the student becomes his adviser, and, together with those with whom the student is taking first and second minor courses, forms a committee with general supervision over the student's general course of study. This committee is expected to follow the student's work and see that he is helped to lay out an intelligently planned course, and to give him such advice as may be necessary concerning his scholastic career.

Amount of Work.—Each student is required to attend a minimum of four class, lecture, or laboratory exercises per week in the first year of his graduate study; and in no case is he permitted during his course to attend more than twelve per week.

Each first year student doing full work must take at least four unit courses. A unit course is one which requires ten hours of time per week through one semester, irrespective of the mode of distribution of that time in class work, laboratory work and private study. Four such courses or their equivalent constitute a full minimum program for one semester, and eight such courses, or their equivalent of graduate grade, constitute the minimum year's work required for a master's degree.

Therefore, registration for full work for the master's degree ordinarily provides for three unit courses, or their equivalent, per semester, in addition to a thesis, the time devoted to the thesis being ordinarily reckoned as equivalent to that for one unit course, or ten hours of time a week. If a student is excused from writing a thesis he must take four unit courses or their equivalent per semester.

Unless otherwise specified by the department concerned, a course for graduates and advanced undergraduates, not open to students below senior grade and counting four or five hours of undergraduate credit, if taken by graduate students, will be treated as a unit course; when counting less than four hours of undergraduate credit, such a course, if taken by graduate students, will be treated as a half-unit course.

Unless otherwise specified by the department, a course the prerequisites of which are such as to make it possible for juniors or sophomores to be admitted, if taken by a graduate student, is counted as a half-unit course, or a quarter-unit course, according to the number of hours of undergraduate credit for which the course is given.

Miscellaneous and Listener's Courses.—Graduate students are permitted under proper circumstances to attend classes as visitors, or listeners, and to elect miscellaneous subjects, that is, courses which do not count towards an advanced degree. Under the authority conferred by the faculty on the Dean no student will be permitted by the Dean to visit more than one class or to take more than one miscellaneous subject, nor is any subject open as a listener's or miscellaneous course unless it has a specific educational bearing on the student's major or minor subjects of study.

The above regulations concerning the program of studies are laid out primarily for first year students. Second and third year graduate students fill out their programs irrespective of unit value of courses, according to their needs, under the advice of their instructors.

Students On the Staff.—Assistants and others on the University staff who undertake to do graduate work are permitted to take an amount of work determined by the terms of their employment. Such a student, applicant for a master's degree, must ordinarily stay through at least two years. In no case will the doctor's degree be conferred upon an applicant otherwise fit in less than four years if he is on the staff in any capacity.

Residence and Transfer of Credit.—Continuous residence and study are required of all members of the Graduate School, unless they are granted leave of absence by the Dean, upon recommendation of the professors in charge of their work, for the purpose of carrying on elsewhere studies or investigation in the line of work for their degrees.

Students should note, moreover, that all the work for the master's degree must be done in residence at the University, excepting in the case of members of the staff who have spent half of their time in study through a year at some other institution, and then do the rest of the work required during a year's residence here. Credit for work done elsewhere is not "transferred." The candidate is examined here on all the work required for the degree.

CHARACTER OF GRADUATE WORK

The principal aim of graduate study is the development of the power of independent work and the promotion of the spirit of research. Each candidate for a degree is expected to have a wide knowledge of his subject and of related fields of work; for the graduate student is not expected to get from lecture and laboratory courses all the knowledge and training necessary to meet the requirements for his degree.

Students, especially candidates for the doctor's degree, are warned against restricting themselves to the courses prescribed or suggested by the departments in which they are studying. Each student is expected to do a wide range of private reading and study, and in many cases will find it advisable to take one or more courses of lectures quite outside the field of his chosen subject.

THE MASTER'S DEGREES

Candidates for the degree of Master of Arts or Master of Science are required to do at least one year's work in residence and to write a thesis.

Majors and Minors.—A candidate for a master's degree may do all his work in one subject, or he may select a major and one minor, or a major and two minors. A major or minor denotes the field of knowledge of a department, or such part thereof as constitutes a separate and independent division of that field. The candidate must do at least half his work in his major subject.

Master's Thesis.—Each candidate for a master's degree is also required to present a thesis on some subject approved by the professor in charge of his major work and the faculty of the School. The requirement of a thesis may be waived, however, upon the recommendation of the head of the department in which the student is doing his major work, and the approval of the Dean, provided application to waive the thesis is made at the beginning of the year. *In no case will permission to take the degree without the thesis be given by the Dean if applied for later than the latest date for the approval of thesis subjects, as shown by the calendar.*

The thesis required from a candidate for a master's degree ordinarily will demand about one-fourth of the student's time. The thesis must be typewritten, on "thesis paper," and the title-page

must be printed. The thesis in its final form, together with a certificate of approval by the proper officer, must be left by the professor in charge at the Dean's office at the time set in the calendar.

The Masters' Degrees in Engineering

Two classes of second degrees are open to graduates of the College of Engineering, namely, academic and professional.

The academic second degree in engineering is Master of Science, following Bachelor of Science, in Architecture, Architectural Engineering, Civil Engineering, Electrical Engineering, etc. This degree is conferred in accordance with the regulations described above for *academic work in residence only.*

The *professional* second degrees in Engineering are as follows:

Master of Architecture after B.S. in architecture.

Architectural Engineer after B.S. in architectural engineering.

Civil Engineer after B.S. in civil engineering or B.S. in municipal and sanitary engineering.

Electrical Engineer after B.S. in electrical engineering.

Mechanical Engineer after B.S. in mechanical engineering.

Mining Engineer after B.S. in mining engineering.

Civil Engineer, Electrical Engineer or Mechanical Engineer, after B.S. in railway engineering, according to the course.

Professional degrees are conferred upon two classes of candidates: (1) graduates of the College of Engineering of the University of Illinois who have been engaged in acceptable professional work away from the University for a period of not less than three years after receiving the degree of Bachelor of Science; (2) graduates of the University of Illinois, or of institutions of equal standing, who have been engaged in acceptable professional work in residence at the University for a period of not less than three years after receiving the degree of Bachelor of Science.

In "acceptable professional work" may be included contributions to technical literature, activity in professional societies, investigation of engineering problems, and the teaching of engineering subjects.

A candidate must declare his candidacy and file with the Dean of the College of Engineering, as chairman of the committee in charge, a detailed statement covering his professional study and experience, not later than the first Monday in November preceding

the commencement at which he proposes to qualify. Prior to December 31 next succeeding, he must submit for approval an outline of his proposed thesis and he must file his completed thesis not later than April 1. If the statement of professional experience and study and the thesis are accepted, the candidate must present himself at commencement in order to receive the degree.

Candidates for professional engineering degrees who already hold the degree of Master of Science, may qualify for the professional degree after two years of professional work.

A candidate for a professional engineering degree must pay the incidental fee of twenty-four dollars on being notified that his professional study and experience are accepted as qualifying him to enter as a candidate for the degree. No one will be enrolled as a candidate for the degree at the following commencement who does not pay his fee at this time. When a candidate for a professional engineering degree has once been accepted and paid his fee, he is eligible to receive the degree at any time within five years, without additional fee, on completion of the requirements; provided, however, that unless he completes the requirements within two years his name will be dropped from the list of candidates and in order to receive the degree within the five-year period he must register once more.

THE DEGREE OF DOCTOR OF PHILOSOPHY

General Statement of Requirements.—The requirements for the degree of Doctor of Philosophy are a thorough mastery of a selected field of study, evidence of the power of independent investigation in this field, a broad knowledge of the wider field of study of which this major subject is a part, a general acquaintance with related fields of knowledge and a mastery of all branches of study which are necessary to a full knowledge of the main subject. Each student who is seeking this degree is expected to choose for study and final examination a major subject, or field of study, and a first and second minor. The major subject is the field in which the student expects to become expert and an authority. The first minor should ordinarily be a subject closely related to the major and, under certain conditions and with proper approval, may be a subdivision of the major field of study. The second minor should be chosen outside of the major field of study.

When a candidate chooses any subject as his major, and a division of that subject as his minor, he is not permitted to choose as a second minor any division of work in that same department, excepting by vote of the executive faculty of the School.

The candidate's list of subjects must receive the approval of the head of the department in which he chooses his major work and of the Dean of the School.

Period of Study.—The *minimum* period of study required for securing the degree of Doctor of Philosophy is three years. The degree is conferred, however, not for residence during a certain period, but for scholarly attainments and power of investigation, as proved by thesis and examinations.

Credit for work done in other universities is not "transferred." The candidate is examined here on the subjects offered by him for the advanced degree. However, his period of residence at another institution of proper grade may be accepted as fulfillment of the residence requirement of the University of Illinois so far as it goes.

At least the first two or the last one of the three years required must be spent at this University.

Examination.—Towards the end of his second year of study, or, by special permission, at the beginning of his third year, the candidate for the degree must submit to a preliminary examination conducted by the members of the faculty with whom he is doing his principal work, in order to determine whether he will be accepted as a candidate for the degree in the following year. This examination is intended to test the student's knowledge of the fields of his major and minor subjects of study. It is partly oral, and may be wholly so. At this time, or before, the candidate will be required to demonstrate his ability to read French and German, and any other language needed for the prosecution of his work.

On or before the last Monday in May of the year in which the candidate expects to come up for his degree, he must submit to a final examination. Besides the written examination set by the departments of the major and minor studies, the candidate must also take an oral examination, given by a committee appointed by the Dean. The oral examination is primarily on the research work of the student, as embodied in his thesis, but it is not confined to this. It extends to the whole field of the study of the candidate.

It will not be confined to the courses which the candidate has attended in the University of Illinois only, if he has done part of the work elsewhere; nor even to the field covered by the courses specifically taken in this or other universities; but will be so conducted as to determine whether the candidate has a satisfactory grasp of his major subject as a whole, and a general acquaintance with the fields of knowledge represented by his course of study.

Before the candidate is admitted to the final examination and the defense of his thesis, he may be required to take any other examination, oral or written, that is thought proper by the various departments in which he has studied. If after having passed his preliminary examination, he fails in the third year of his study to meet the expectations of the professors in charge of his work, or in any way fails to maintain the standard of scholarship and power of research expected of him, he may be refused admission to the final examination.

The final examination in the major and minor subjects may not be divided. The examination must be taken all at one time even though it requires several sessions.

Thesis.—The power of independent research must be shown by the production of a thesis on some topic connected with the major subject of study. The candidate is expected to defend his thesis or dissertation before the members of the faculty, or as many of them as may wish to question him about it, in connection with his final examination.

The subject of the thesis should be chosen not later than the end of the second year of study and must be submitted for formal approval by the faculty not later than the first Monday of November of the year when the degree is expected. Unless previously printed with proper authority, a typewritten copy of the complete thesis, *on thesis paper**, must be in the hands of the Dean not later than noon of the Saturday nearest the middle of May, for submission to the examining committee.

The doctor's thesis must be printed and one hundred copies deposited in the Library of the University not later than the first of June preceding the conferring of the degree. If it is not printed by the first of June, the student must deposit seventy-five dollars

*No other will be accepted by the Dean.

($75) or a bond for that amount satisfactory to the Comptroller of the University and the Dean of the Graduate School. If a bond is accepted, it must be replaced at the end of one year with a cash deposit. At the end of two years, if the thesis has not then been printed by the student, the University will print such part of it as it deems best.

The cash deposit made by the student who does not print his thesis by the end of the second year after his degree is conferred becomes the property of the University, to be used for the general purpose of printing theses.

The title page of each thesis, whether typewritten or printed, must bear the words, "Submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in—(here put the major subject)—in the Graduate School of the University of Illinois." The title page must also contain the full name of the author, his previous degrees, the full title of the thesis, the year of imprint, and, if a reprint, the title, volume and statement of the pagination of the volume from which it is reprinted. Each thesis must have an appendix giving a short biography of the candidate, including the institutions he has attended, his degrees and honors, the titles of his publications, and such other matters as are pertinent.

Doctor's Degree in Engineering.—The degree of Doctor of Philosophy in Engineering is offered in certain lines of academic graduate work of a high scholastic type in engineering science that will attract students who wish to prepare themselves as teachers, investigators and experts.

The general requirements for this degree, as to preliminary education, linguistic attainments, etc., are the same as in other lines.

The following lines of engineering science are open as majors for the present:

Engineering mechanics
Hydraulic and sanitary engineering
Steam engineering
Electrical engineering
Heating and ventilation engineering
Railway engineering
Masonry construction and structural engineering
Coal mining engineering

The first minor may be any of the above or one of the following fundamental sciences or an authorized combination of two of them:

Theoretical mechanics
Mathematics
Thermodynamics
Chemistry
Geology
Physics (Experimental or mathematical)
Zoology
Botany

The second minor should be in other than engineering subjects.

SCHOLARSHIPS AND FELLOWSHIPS

A number of fellowships and scholarships have been established by the Trustees of the University. To first year graduate students of ability and promise there are open a number of scholarships with a stipend of $250 each and freedom from tuition, incidental and laboratory fees. To second and third year graduate students, that is, those who have had one or two years of graduate study, there are open fellowships with a stipend varying from $300 to $500, with freedom from fees. The larger stipends are given only to students who are expected to take their degrees within the year. Each holder of a fellowship or scholarship must pay the matriculation fee of ten dollars, unless he holds a first degree from the University of Illinois, and also the diploma fee of five dollars on receiving his diploma.

Candidates for these scholarships and fellowships must be graduates of the University of Illinois, or of colleges or universities having equivalent requirements for bachelors' degrees.

Application must be made upon blanks to be obtained from the Dean of the Graduate School. These application forms should be addressed to the Dean of the Graduate School as early as possible in February and not later than the first of March of the academic year preceding that for which the fellowship is desired. No application will be considered if received later than March first, until after April fifteenth, the date when appointees from the first list of applicants must accept or refuse their appointments.

Persons appointed are notified on April first and must send the Secretary of the Board of Trustees notice of their acceptance or refusal by April fifteenth; and must agree that, if accepted, the appointment will not be resigned to take a similar one in any other institution during the year for which it is awarded.

Nominations to fellowships are made upon the grounds of worthiness of character, scholastic attainments, and promise of success in the principal line of study or research to which the candidate proposes to devote himself.

Scholarships and fellowships are good for one year, but may be renewed for a second or a third year in special cases. An appointment as honorary fellow, without stipend, may be made as specified for paid fellowships in the case of any one who has shown distinguished merit in his work.

Research Fellowships in the Engineering Experiment Station

The Engineering Experiment Station is devoted entirely to research. Its purposes are the elevation of engineering education, and the study of problems of special importance to engineers and to manufacturing, railway, mining, and industrial interests.

Ten research fellowships have been established in the Engineering Experiment Station. These fellowships are open to graduates of approved technical schools and universities, both American and foreign. There is a stipend of $500 a year for each fellowship. Applicants to whom these fellowships are awarded are required to agree to hold them for two years, devoting a part of their time to the work of the Engineering Experiment Station. At the expiration of this period, if all requirements have been met, the degree of Master of Science will be conferred.

Application for these fellowships should be made to the Director of the Engineering Experiment Station not later than February first. Candidates must present with their applications full information concerning themselves, including any written or published papers or results of investigation.

LIBRARIES

The general University library, the library of the State Laboratory of Natural History, and that of the College of Law are all at the University in Urbana. The libraries of the School of Pharmacy and the Colleges of Dentistry and Medicine are in Chicago.

The University library contains 328,000 volumes and 40,000 pamphlets. The University has a subscription list of 3,700 periodicals. The Library of the State Laboratory of Natural History contains 8,200 volumes and 38,200 pamphlets. The library of the College of Law contains the Federal and State Reports, the leading textbooks, and a line of leading periodicals, aggregating more than 15,000 volumes.

The general library of the University is open daily, from 8 a. m. until 10 p. m. and on Sunday from 2 p. m. to 6 p. m.

The Mason Historical Library.—The valuable library of western history collected by Edward G. Mason, Esq., long President of the Chicago Historical Society, is in the Public Library of the city of Champaign, and is accessible to University students.

The Dittenberger Classical Library.—The University possesses the library of Wilhelm Dittenberger, at one time Professor of Classical Philology in the University of Halle. This library contains 5,600 items. It includes the works of the poets and prose writers, numerous works on grammar and history of literature, and between four and five thousand dissertations and programs on special topics. There are also many works dealing with other departments of classical philology, as epigraphy, history of ancient peoples, archaeology, philosophy, history of art, geography, chronology, metric, etc.

The Heyne Library of Germanics.—The entire library of Professor Moritz Heyne of the University of Göttingen was bought by the University. In contains about 5,200 volumes. The collection is rich in the general field of German philology and especially in lexicography. It has many rare first editions of works of German literature from the sixteenth, seventeenth and eighteenth centuries and has sets of a number of rare periodicals. It is also rich in works upon the history of German civilization.

The Gröber Library in Romance Languages.—The University also possesses the library of Professor Gröber of the University of Strassburg. This library contains about 6,500 titles, and, added to what is already in the University library, furnishes somewhat over 10,000 volumes for this field.

The Vahlen Library, the property of the late Johannes Vahlen, Professor of Classical Philology at the University of Berlin, contains about 10,000 volumes and is in itself an excellent working library in classical philological literature. Being especially well

supplied with texts of Greek and Latin authors, it supplements the Dittenberger collection. The addition of this interesting collection to the already good classical library of the University gives this institution one of the best libraries in this field of research in the country.

The Aron Library, collected by the late teacher and student of pedagogy, R. Aron, contains about 20,000 volumes. It is a scholarly collection of educational documents, among them many original and early editions, and furnishes firsthand material for the study of educational movements in Europe, especially in Germany, from the time of Luther and Comenius to the present. The collection of German "Fibeln" or school readers, is unique, and the material for the history of juvenile songs and literature, the set of 17th and 18th century atlases, the collection of rare hymn books and juvenilia make the collection very useful to students of education.

The classical collections have been further strengthened by the purchase, recently, of a collection of pamphlets in classical philology, including more than twelve thousand items.

Furthermore, notable additions have been made in the past few years to the libraries of the departments of history, education, economics, English, and political science.

FEES AND EXPENSES

Except as noted below, graduate students pay fees as follows:

Matriculation fee	$10.00
Incidental fee, each semester	12.00
Diploma fee	5.00

All graduate students who have not matriculated as undergraduates at the University of Illinois pay the matriculation fee on entrance.

All graduate students pay the diploma fee on being recommended for their degrees.

No tuition or incidental fee is charged for graduate courses to scholars, fellows, or members of the corps of instruction or the staffs of the scientific bureaus or experiment stations, nor for undergraduate courses on their study lists if approved by the heads of the departments and by the Dean of the School as necessary or desirable for the proper completion of the work for the degree.

Otherwise, graduate students who take undergraduate courses must pay the proper undergraduate fee.

Each student working in laboratories, or in the drafting or engineering classes, is required to make a deposit of from 50 cents to $10.00, to pay for chemicals and apparatus used, and for any breakage or damages. But no charges or deposits for laboratory materials are required from scholars, fellows, or members of the corps of instruction or scientific staffs mentioned above.

Table board may be obtained at prices ranging from $4.00 per week.

Room rent, with two in a room, ranges from $2.50 per week.

THE GRADUATE CLUB

The Graduate Club is an unofficial organization of the graduate students and graduate faculty. Its purpose is to furnish an opportunity for those working in different departments to become acquainted with one another and thus counteract the tendency toward narrowness which intense specialization may sometimes induce.

DEPARTMENTS OF INSTRUCTION

AGRONOMY

Students who wish to do their major work in agronomy must have had the major courses offered in that subject to undergraduates in the College of Agriculture of the University of Illinois, or the equivalent. While every one seeking a doctor's degree with agronomy as a major will be required to have a good knowledge of the whole field of agronomy, each student is expected to be especially prepared in some one of the following divisions of the field: soil fertility, plant breeding, soil physics, crop production and soil biology.

Students who are taking their major work in other departments and choose agronomy as a minor, must have had previously the work in chemistry, botany and other fundamental sciences prescribed for the undergraduate courses in agronomy in the College of Agriculture, or the equivalent.

Courses for Graduates

101. Soil Investigation.—A study of systems of soil investigation; sources of error and methods of control; interpretation of results. *Once a week; second semester. One unit.*

Professor Hopkins.

103. Soil History.—Different systems of agricultural practice and their ultimate effect upon the soil. *Once a week; second semester. One unit.* Professor Hopkins.

104. Seminar in Agronomy.—*Once a week; both semesters. Half unit.* Dr. Whiting and others.

112. Plant Breeding.—This course includes a detailed study of the experiments at this station, and of methods and results reported from other states and from foreign countries. *Twice a week; both semesters. One to two units.* Professor Smith.

118. Investigation.—A special problem is chosen by each student. *Consultation one to five times a week for different students; both semesters. One to four units.*

Professors Hopkins, Smith, Mosier, Dr. Whiting.

Courses for Graduates and Advanced Undergraduates

9. Soil Physics and Management.—*Five times a week; both semesters.* Professor Mosier.

11. Soil Biology.—Quantitative studies with respect to fertility of the biochemical activities of soil microörganisms. *Five times a week; second semester. One unit.* Dr. Whiting.

12. Soil Fertility, Fertilizers, Rotations.—The influence of fertility; effect of different crops upon the soil and upon succeeding crops, etc. *Five times a week; second semester.*

Professor Hopkins.

22. Plant Breeding.—The improvement by breeding of field crops, including the grains, grasses, and legumes; the principles and methods of selection with critical studies of results obtained by various investigators. *Twice a week; second semester.*

Professor Smith.

24. Mechanical Composition of Soils.—The mechanical composition of the soil and its influence upon granulation, absorption and retention of moisture, and other physical properties affecting crop production. *Arrange time; first semester.* Professor Mosier.

ANIMAL HUSBANDRY

Students entering graduate work in animal husbandry must have had a thorough training in the fundamental principles of the subject either in connection with or in addition to an agricultural course of study substantially equivalent to that offered in this University.

Courses for Graduates

103. Live Stock Experimentation.—Objects, methods and the sources of error in experimental work dealing with the feeding, breeding and management of farm animals. *Once a week; both semesters. One-half to one and one-half units.*

Professor Davenport.

110. Animal Nutrition.—The course includes a thorough study of the chemical and physiological changes and processes involved in the activities of animal life. *Three times a week; both semesters. One unit.* Professor Grindley, Dr. Joseph.

111. Animal Nutrition.—A study of methods employed in the examination and analysis of feeding stuffs; also animal substances including flesh, fat, bone, urine, feces, and manufactured animal products. *Three to five times a week; both semesters. One to two units.* Professor Grindley.

112. Investigation.—Opportunity is afforded to pursue investigations along the following lines:

(a) Economic Factors Involved in the Various Phases of Meat Production.

(b) Systems of Live Stock Farming.

(c) The Valuation of Pedigrees. *(a), (b) and (c), once a week; both semesters. One to two units.* Professor Mumford.

(d) Animal Nutrition. A research course in animal nutrition including digestion and metabolism experiments and biochemical studies connected with the nutrition of farm animals. *Five times a week; both semesters. One to two units.*

Professor Grindley, Dr. Joseph.

(e) Genetics. Research problems in heredity and variation. *Five times a week; both semesters. One to two units.* This course may be taken during the summer. Assistant Professor Detlefsen.

116. Seminar.—*Arrange time; both semesters. Quarter unit.*

Members of the Staff.

117. Genetics.—A study and criticism of the more important genetic experiments, the biological and mathematical methods employed, and the validity of the conclusions. *Three to five times a week; both semesters. One to two units.*

Assistant Professor Detlefsen.

Courses for Graduates and Advanced Undergraduates

7. Principles of Animal Nutrition. *Five times a week; first semester.* Professor Grindley, Dr. Joseph.

22. Advanced Stock Judging.—A study of animal conformation with reference to market and show yard form; quality and condition. *Five times a week; first semester.*

Various members of the department.

24. Meat.—A study of the influence of type, condition, age, sex and feeds upon the yield and market grade of meat products. *Once a week; second semester.* Professor Coffey.

25. Wool.—A study of the factors affecting the quality, quantity, strength, and condition of wool. *Once a week; second semester.* Professor Coffey.

[Not given 1915-16]

26. Swine.—The factors of animal nutrition that have to do with the large and economical production of pork and the determination of type in swine. *Once a week; second semester. Half unit.* Mr. Carmichael.

27. Sheep Husbandry.—Dealing with the factors determining the importance of the industry in leading sheep growing countries and particularly in different parts of the United States. *Arrange time; second semester.* Professor Coffey.

28. Advanced History of Breeds of Live Stock.—A study of the methods of prominent breeders, and the performances of great individual beef animals, horses, sheep and swine. *First semester.*

Professor Mumford and Other Members of the Department.

29. Systems of Live Stock Farming.—A study of the principles of farm management as applied to live stock farming. *Twice a week; second semester.*

Assistant Professor Handschin.

30. Genetics.—The fundamental principles of heredity and variation. *Daily; second semester.*

Assistant Professor Detlefsen.

31. Principles of Animal Nutrition.—Continuation of 7. *Three to five times a week; both semesters.*

Professor Grindley, Dr. Joseph.

32. Marketing Live Stock.—A study of marketing and methods of marketing live stock and their products. *Twice a week; second semester.* Professor Mumford, Mr. Wilcox.

ARCHITECTURE AND ARCHITECTURAL ENGINEERING

The prerequisite for graduate work in architecture and architectural engineering is the equivalent of the undergraduate courses required for the degree of Bachelor of Science in architecture and architectural engineering in the branches of the subjects in which registration is desired.

Courses for Graduates

101. Architectural Construction.—Design of special structures. *Twice a week; both semesters. One-half to one unit.*

Professor Ricker and Professor Provine.

102. Sanitation of Building.—The planning of the sanitation for buildings, modern methods of design and installation. *Twice a week; first semester. One-quarter to one-half unit.*

Professor Ricker.

103. Advanced Architectural Graphics.—Advanced course in the investigation and solution of problems by graphical methods. *Twice a week; second semester. One to two units.*

Professor Provine.

104. Architectural Design.—Advanced work in Architectural Design. *Twice a week; both semesters. One to four units.*

Assistant Professor Ash.

105. Architectural Practice.—Contracts, specifications and office methods. *Twice a week; first semester. One-quarter to one-half unit.* Professor Provine.

106. Architectural History.—Special research work. *Twice a week; first and second semesters. One-half to two units.*

Professor Ricker.

ASTRONOMY

The prerequisites for graduate study in astronomy are mathematics through the calculus, a year's course in observational astronomy, and a course in college physics.

Courses for Graduates

101. SEMINAR. *Three times a week; both semesters. One unit.* Professor STEBBINS.

102. STELLAR ASTRONOMY.—Orbits of binary stars; variable stars; theoretical photometry. *Three times a week; both semesters. One unit.* Professor STEBBINS.

Courses for Graduates and Advanced Undergraduates.

7-8. THEORETICAL ASTRONOMY.—Celestial mechanics; theory of orbits; perturbations; canonical transformations. *Three times a week; both semesters. One unit.* Dr. REED.

9-10. CELESTIAL MECHANICS.—*Three times a week; both semesters. One unit.* Dr. REED.

14. OBSERVATIONAL ASTRONOMY.—The working methods of an astronomical observatory. *Three times a week; second semester. One unit.* Professor STEBBINS.

15. GEODETIC ASTRONOMY.—The sextant, transit, and zenith telescope; methods similar to those of the United States Coast Survey. *Three times a week; first semester. One unit.* Professor STEBBINS.

BACTERIOLOGY

The work outlined under "Courses for Graduates" is open only to graduate students who have had at least one year's work in bacteriology and a good training in chemistry.

Courses for Graduates

103. PHYSIOLOGY OF BACTERIA.—A study of the facts and theories of fermentation and growth and death of bacteria. *Twice a week; first semester. One unit.* Dr. SPERRY.

105. CLASSIFICATION OF BACTERIA.—Variability of species; characters; mutations; standard and biometrical classifications. *Twice a week; second semester. One unit.* Dr. SPERRY.

107. Research in Bacteriology.—The physiology of bacteria and food bacteriology. *Once a week; both semesters. One or two units.* Dr. Sperry.

Courses for Graduates and Advanced Undergraduates.

Graduate students in agriculture, biology or chemistry who have had no bacteriology may choose bacteriology 19 as an introductory course; this or bacteriology 5 is prerequisite for the other courses.

8. Applied Bacteriology.—Decay of organic matter in nature; water bacteria; sewage bacteria; food bacteria. *Twice a week; second semester.* Mr. Tanner.

18. Journal Meeting.—Required of all students specializing in bacteriology. *Once a week; both semesters.* Dr. Sperry.

19. General Bacteriology.—The essentials of the science specially arranged for graduate students. *Twice a week; both semesters.* Dr. Sperry.

26. Pathological Bacteriology.—Disease-producing organisms, their effects upon the animal and the reaction of the host. *Three times a week; second semester.* Dr. Sperry.

27. Epidemiology.—The ways in which contagious diseases are spread. *Twice a week; first semester.* Dr. Sperry.

BOTANY

Candidates for advanced degrees in botany must offer for admission at least 20 hours in University botany, exclusive of botany 1, and inclusive of courses 2a, 3b, 4a, and either 7a, 9b, 17a, or 17b.

Graduate students who desire to elect botany for minor credit must offer the equivalent of 10 hours in University botany, exclusive of botany 1, as a prerequisite to the courses listed for graduates and advanced undergraduates.

Courses for Graduates

101. Cytology.—The influence of external agents on the cell. Reports and discussions of current literature and research results. *Once a week; both semesters. One or two units.*

Professor Hottes.

102. Physiology.—The effects of external stimuli on growth and movement. *Once a week; both semesters. One or two units.*

Professor Hottes.

104. Mycology.—Field and laboratory investigations upon selected groups of fungi. *Once a week; both semesters. One or two units.* Professor Stevens.

106. Plant Pathology.—Diseases of plants, and disease agents. *Once a week; both semesters. One or two units.* Professor Stevens.

108. Taxonomy.—Monographic studies of critical groups. *Once a week; both semesters. One or two units.* Professor Trelease.

Courses for Graduates and Advanced Undergraduates.

9a-9b. Plant Anatomy or Physiology.—Problems to meet the needs of individual students. *Twice a week; both semesters.* Professor Hottes.

10a-10b. Current Botanical Literature.—A weekly review covering the field of botany; supplementary to the various seminar conferences. *Once a week; both semesters.* Professor Trelease.

14a-14b. Heredity, Variation, Evolution.—A comparative study of the cells and of the members of plants, of their adaptations and changes, of the mechanism of heredity, and of the process of evolution. *Twice a week; both semesters.* Professor Hottes.

16. Taxonomy and Ecology of Thallophytes.—Advanced practice on selected groups: (1) Algae and Bryophytes; (2) Fungi. *Once a week; both semesters.* Professor Stevens, Dr. Hague.

17a-17b. Taxonomy and Ecology of Cormophytes.—Advanced practice on selected taxonomic, ecological or economic groups. Specialized studies, as of genera or families of Illinois plants. *Once a week; both semesters.* Professor Trelease.

22a. Morbid Histology.—Studies of the histology of plant tissues and of their parasites in condition of disease. *Once a week; first semester.* Professor Stevens.

22b. Studies of Special Groups of Fungi or Diseases of Special Crops or Groups of Crops. *Once a week; second semester.* Professor Stevens.

CERAMIC ENGINEERING

The prerequisite for graduate work in ceramic engineering is the equivalent of the undergraduate courses required for the degree of Bachelor of Science in ceramic engineering in the branches of the subject in which registration is desired.

Courses for Graduates

101. The Formation of Silicates.—Theoretical principles involving the conceptions of physical chemistry; thermal studies. *Three times a week; first semester. One to two units.* Mr. Stull.

102. Technology of the Clay Industries.—Mineralogical constitution of clays; plasticity and the colloidal state; pyro-chemical and physical changes; composition and constitution of bodies; glazes and enamels. *Three times a week; both semesters. One to two units.* Mr. Stull.

103. Technology of Cements.—Composition and constitution of cements; hydration and dehydration of cementing compounds; action of catalyzers. *Three times a week; second semester. One to two units.* Mr. Stull.

104. Technology of Glass.—Fusion studies of glassy silicates; limiting compositions; physical and chemical properties of glasses. *Twice a week; second semester. One to two units.* Mr. Stull.

Courses for Graduates and Advanced Undergraduates

Graduates of courses other than Ceramic engineering who have the necessary prerequisites may take the following courses for minor credit.

3. Industrial Calculations.—Chemical and physical calculations applying to the operation of furnaces, kilns, and dryers; temperature measurements; ceramic stoichiometry. *Three times a week; first semester.* Mr. Hursh, Mr. Williams.

5. Ceramic Bodies.—Composition and properties of ceramic body mixtures; effects of various ingredients; development of special bodies. Lectures; laboratory. *Daily; second semester.* Mr. Radcliffe.

6. Glazes.—Production of glazes and enamels; limits of composition; classification; properties and defects common to each class; effect of variation in composition; modes of application. Lectures; laboratory. *Daily; first semester.* Mr. Stull.

8. Glass.—Raw materials, preparation, compounding, melting, and shaping; chemical principles involved in the manufacture and decoration of the various types of vitreous silicates. *Twice a week; second semester.* Mr. Stull.

10. Cements.—Cements, limes, plasters; composition; reactions; methods of manufacture and testing. *Three times a week; first semester.* Mr. Hursh.

13. Cement Laboratory.—Preparation of cementing substances, study of properties and reactions involved. *Three times a week; second semester.* Mr. Hursh.

14. Cement Laboratory.—The production of waterproof and sea resisting cements: cement colloids; polychrome pigments for fresco decoration; cement colors; cold water paints. *Three times a week; second semester.* Mr. Hursh.

15. Glass Laboratory.—Soda-lime, potash-lime, lead, barium, and zinc silicates; boro-silicates; properties of fused and solidified glasses; practical glass problems. *Three times a week; first semester.* Mr. Stull.

16. Glasses and Enamels.—Continuation of 15. Opaque, colored, and optical glasses; enameling of metals. *Three times a week; second semester.* Mr. Stull.

CHEMISTRY.

Graduate students whose major subject is in some other department than chemistry, before taking graduate work for credit in this department, must have had the equivalent of 15 university hours in chemistry, and the ground covered must have included satisfactory work in general chemistry and in qualitative and quantitative analysis. Such students are advised to take Chemistry 31, 33, (or 102, 102a), 5b, 5c, 15, 14a, 14b, and 9a and 9b. Courses of a more special nature will not, as a rule, be accepted for graduate work unless preceded by one of the above courses.

Graduate students who are candidates for an advanced degree in chemistry must have had the equivalent of 30 university hours in chemistry, and this must include satisfactory courses in general chemistry, qualitative and quantitative analysis, physical chemistry, and organic chemistry. They should have had courses in mathematics, including analytical geometry and, if possible, the calculus. The physical chemistry requires one year's work in physics as a prerequisite. Before receiving the degree of Doctor of Philosophy such students are expected to complete work equivalent to courses 31, 33 (or 102 and 102a), 14a, 14b, 9a, 9b, 101 and 111. They are advised to take at least brief courses in gas analysis, iron and steel analysis, water analysis, assaying and chemical technology.

For students in chemistry, 5a, 13a, 9 and 9c will not be accepted for graduate credit and 9a, 9b, 14a, 14b, 31 and 33 will be accepted

only from the students entering the Graduate School with the equivalent of 30 semester hours in chemistry.

Courses for Graduates

102. Advanced Physical Chemistry.—This course, together with 102a, is intended to cover a period of two years. The subject is treated from the standpoint of *Molecular Kinetics and Thermodynamics. Twice a week; both semesters. Three-quarters unit.*

Professor Washburn.

[Not given in 1915-16.]

102a. Advanced Physical Chemistry.—Chemical equilibrium; the Phase Rule; certain portions of thermochemistry, photochemistry; the thermodynamics of electrochemistry. (A continuation of 102, with which it alternates.) *Twice a week; both semesters. Three-quarters unit.* Professor Washburn.

102b. Advanced Electrochemistry.—The modern theories of solution and the principles of thermodynamics in their application to the problems of electrochemistry. *Twice a week; second semester. Three-quarters unit.* Dr. MacInnes.

102c. Advanced Physical and Electrochemistry.—This course must be preceded or accompanied by Chemistry 102, 102a, or 102b. *Twice a week; first semester. One-half to one unit.*

Professor Washburn, Dr. MacInnes.

102d. Electrochemistry.—This course includes a discussion of theoretical and applied electrochemistry with the emphasis chiefly on the technical side of the subject. *Once a week; first semester. Half unit.* Dr. MacInnes.

102e. Special Topics in Physical Chemistry.—The course will be conducted on the seminar plan and the topics considered will vary from year to year. Subject for 1915-1916: Chemistry of the Radioelements, and Radioactivity. *Once a week; first semester. Half unit.* Professor Washburn.

103. Advanced Inorganic Chemistry.—Descriptive inorganic chemistry; the rarer elements; the periodic system. *Two to five times a week; both semesters. One half to one and one-fourth units.* Professor Balke.

103a. Advanced Analytical Chemistry.—*One to five times a week; second semester. One-half to one and one-quarter units.*

Assistant Professor Smith.

103b. Special Topics in Inorganic Chemistry.—Lectures and Seminar. Subject for 1915-1916. The Chemistry of the Higher Order Compounds. *Twice a week; first semester. Three-quarters unit.* Assistant Professor Smith.

103c. Special Topics in Inorganic Chemistry.—Seminar. The Determination of Atomic Weights. *Twice a week; second semester. Three-quarters unit.* Professor Balke.

103d. Advanced Qualitative Analysis.—Designed especially for those intending to teach qualitative chemistry. *One to three times a week; first semester. One-half to one unit.* Assistant Professor Weber.

104. Advanced Organic Chemistry.—Seminar. A systematic study of the open chain compounds of the carbon, hydrogen and oxygen atoms from the standpoint of the atomic linking theory, followed by the study of tautomerism, stereochemistry and the carbohydrates. *Three times a week; both semesters. Three-quarters unit.* Assistant Professor Derick, Dr. Kamm.

[Not given in 1915-16]

104a. Advanced Organic Chemistry. (Continuation of 104, with which it alternates). A systematic study of the closed chain compounds of the carbon, hydrogen and oxygen atoms and of the organic compounds of nitrogen, followed by the study of the ureids, alkaloids, and color and constitution. *Three times a week; both semesters. Three-quarters unit.* Assistant Professor Derick, Dr. Kamm.

104b. Advanced Quantitative Organic Analysis.—The quantitative chemistry of the proteins, alkaloids, glucosides, volatile oils, and other constituents of animal and vegetable tissues. *Twice a week; both semesters. Three-quarters unit.* Dr. Beal.

104c. Special Topics in Organic Chemistry.—Seminar in which recent books dealing with special phases of organic chemistry are read and discussed. Topic for 1915-1916: *The Organic Chemistry of Nitrogen.* Sidgwick. *Once a week; second semester. One-fourth unit.* Assistant Professor Derick, Dr. Kamm.

105. Chemistry of Plants.—*Twice a week; second semester. three-quarters unit, or one and one-quarter units.* Dr. Lewis.

105a. Advanced Physiological Chemistry.—Special investigations. Laboratory. *One to five times a week; first or second semester. One-quarter to one and one-quarter units.* Dr. Lewis.

105b. Advanced Physiological Chemistry.—The general biological importance of diffusion, solutions, chemical equilibrium, absorption, colloids, osmosis, permeability and enzymes. *Twice a week; both semesters. Three-quarters unit.* Dr. Lewis.

106. Animal Chemistry (Animal Nutrition)—*Five times a week; both semesters. One to one and one-half units.*

Professor Grindley.

107. Calorimetry.—Standards and methods. *One to three times a week; both semesters. One-half to one unit.*

Professor Parr.

107a. Gas Manufacture.—Carbonization processes, ovens and by-products. *Once a week; second semester. One-half unit.*

Professor Parr.

108. Advanced Metallography.—The constitution and microstructure of metals and alloys; the relations between their properties, chemical and mechanical treatment, and structure. *Twice a week; first semester. Three-quarters unit.*

Assistant Professor McFarland.

109. Advanced Industrial Chemistry.—Seminar. A detailed study of some of the more important chemical industries, and the development and chemical control of processes. *Twice a week; both semesters. Three-quarters unit.*

Assistant Professor McFarland.

110. Water Supplies.—A study of the sources of contamination of water supplies and the purification of water for potable or technical use. *One to five times a week; both semesters. One-half to one unit.* Professor Bartow.

111. Research.—*Once a week; both semesters.*

Physical and Electrochemistry. Professor Washburn, Dr. MacInnes.

Inorganic Chemistry. Professor Balke, Assistant Professors Smith, Weber.

Analytical Chemistry. Assistant Professor Smith.

Food Chemistry. Dr. Beal.

Organic Chemistry. Professor Noyes, Assistant Professor Derick.

Water Chemistry. Professor Bartow.

Physiological Chemistry. Dr. Lewis.

Animal Chemistry Nutrition. Professor Grindley.

INDUSTRIAL CHEMISTRY. Professor PARR, Assistant Professor MCFARLAND.

Courses for Graduates and Advanced Undergraduates

5c. FOOD ANALYSIS.—Quantitative organic analysis, with special reference to the examination of food products: alcohols, carbohydrates, fats and oils, cereals, nitrogenous bodies, preservatives, and colors. *Five times a week; second semester.* Dr. BEAL.

*6. CHEMICAL TECHNOLOGY.—Technological chemistry as illustrated in those industries having a chemical basis for their principal operations and processes. *Three times a week; second semester.* Assistant Professor MCFARLAND.

*7. METALLURGY.—The time of the course is divided about equally between general metallurgy, metallurgy of iron and steel, and metallurgy of the non-ferrous metals. *Three times a week; first semester.* Assistant Professor MCFARLAND.

7a.—METALLURGY OF THE NON-FERROUS METALS.—Particularly copper, lead, zinc, gold and silver. *Three times a week; second semester.* Assistant Professor MCFARLAND.

8. IRON AND STEEL ANALYSIS.—*Three times a week; second semester.* Assistant Professor SMITH.

9a. ORGANIC SYNTHESIS AND ULTIMATE ANALYSIS.—*Twice a week; first or second semester.*

Assistant Professor DERICK, Dr. KAMM.

9b. ORGANIC SYNTHESIS AND QUALITATIVE ORGANIC ANALYSIS.—Continuation of 9a, to accompany Chemistry 14b. *Twice a week; first or second semester.*

Assistant Professor DERICK, Dr. KAMM.

10a. STUDY OF WATER SUPPLIES.—History, sources, contamination, and standards of purity of potable waters and waters for industrial purposes, together with practice in analytical methods. *Three times a week; second semester.* Professor BARTOW, Dr. CORSON.

13b. ADVANCED AGRICULTURAL ANALYSIS.—This course is offered to students who specialize in agricultural chemistry. *Five times a week; second semester.* Dr. BEAL.

14a-14b. ORGANIC CHEMISTRY.—Lectures; recitations. Noyes's

*Certain required inspection trips will be arranged in connection with courses 6 and 7. Students registering in these courses should take into consideration the expense involved, which will approximate $15.00 for each course.

Organic Chemistry. This course should be accompanied by Chemistry 9a and 9b. *Four and two times a week; both semesters.*

Professor NOYES.

15. PHYSIOLOGICAL CHEMISTRY.—*Five times a week; first semester.* Dr. LEWIS.

15a. PROBLEMS OF METABOLISM (INTENDED ESPECIALLY FOR MEDICAL STUDENTS). *Twice a week; second semester.* Dr. LEWIS.

21. QUALITATIVE ORGANIC ANALYSIS.—Systematic methods for identification of pure organic compounds and mixtures. *Twice a week; first or second semester.*

Assistant Professor DERICK, Dr. KAMM.

22. ANIMAL CHEMISTRY (ANIMAL NUTRITION.)—The chemical composition of animal products and feeding stuffs. *Five times a week; first or second semester.* Professor GRINDLEY.

27. QUALITATIVE ANALYSIS OF THE RARE ELEMENTS.—*Three times a week; second semester.* Professor BALKE.

31. ELEMENTARY PHYSICAL CHEMISTRY.—*Four times a week; second semester.* Professor WASHBURN.

33. ELEMENTARY PHYSICAL CHEMISTRY.—A laboratory course to accompany course 31. *Twice a week; second semester.*

Dr. MACINNES.

35. ELECTROCHEMISTRY.—Lectures and laboratory work. See also Chemistry 102b. *Three times a week; first semester.*

Dr. MACINNES.

37. EXPERIMENTAL PROBLEMS IN PHYSICAL AND ELECTROCHEMISTRY.—Technical and Scientific problems are worked out in the laboratory by students individually. Each student must spend at least twelve hours a week on his work. *First semester.*

Professor WASHBURN, Dr. MACINNES.

61. INDUSTRIAL CHEMICAL LABORATORY.—The preparation and purification of chemical products from raw materials on a scale sufficient to afford data for determining the economy of the processes employed. This course should be accompanied by either Chemistry 6 or 109. *Three times a week; second semester.*

Assistant Professor MCFARLAND, Dr. BRODERSON.

66. TECHNOLOGY OF GASES.—*Once a week; second semester.*

Professor PARR.

69. METALLURGICAL LABORATORY AND ASSAYING.—The fire assay of gold, silver, lead and copper ores, mattes, and bullion, together

with special experiments illustrating the underlying metallurgical principles. *Twice a week; first semester.*

Assistant Professor McFarland.

70. Advanced Assaying and Ore Testing.—(A continuation of Chemistry 69.) *Twice a week; second semester.*

Assistant Professor McFarland.

71. Advanced Methods of Metallurgical Analysis.—Study and comparison of selected methods for analyses of ores, alloys and metallurgical products. *Twice a week; first semester.*

Assistant Professor McFarland.

72. Paints, Oils, Turpentines, Varnishes and Protective Coverings for Wood and Metals.—Lectures and laboratory. *Twice a week; first semester.* Professor Parr.

76. Calorimetry of Fuels.—Methods for determining the heat values of solid, liquid, and gaseous fuels. (An advanced course.) *Twice a week; second semester.* Professor Parr.

77. Composition and Classification of Coal.—Classification, changes in composition, weathering, spontaneous combustion, formation of mine gases. Lectures; assigned reading. *Once a week; second semester.* Professor Parr.

78. Metallography.—Constitution and microstructure of metals and alloys and on the relations between their properties, chemical and mechanical treatment and structure. Lectures; reading; and laboratory. *Twice a week; second semester.*

Assistant Professor McFarland.

93. Journal Meeting.—For seniors, and graduates. *Once a week; both semesters.* Assistant Professor McFarland.

95. History of Chemistry.—Lectures and assigned reading. *Twice a week; first semester.* Assistant Professor Smith.

Besides the formal courses, outlined above, regular scientific meetings are held by the colloquiums of industrial, physical and inorganic, physiological and organic chemistry; by the Chemical Club; by Phi Lambda Upsilon and by the University of Illinois Section of the American Chemical Society.

CIVIL ENGINEERING

The prerequisite for graduate work in civil engineering is the equivalent of the undergraduate courses required for the degree

of Bachelor of Science in civil engineering in the branches of the subject in which registration is desired.

Courses for Graduates

106. Reinforced Concrete Design.—Application of theory of elasticity to the design of reinforced concrete structures. Specifications for reinforced-concrete design. Concrete forms. Typical reinforced-concrete structures. Methods and costs of reinforced-concrete construction. *Twice a week; both semesters. One and one-half units or more.* Assistant Professor McDaniel.

107. Bridge Engineering.—Theory of deflections; the general problem of the statically indeterminate frame, applications to swing bridges and arches; special graphical methods; theory of suspension bridges; secondary stresses; impact. *Twice a week; both semesters. One unit or more.* Professor Ellis.

124. Steel Building Construction.—The design of steel framing of fireproof office buildings, hotels, and industrial buildings; theory of wind bracing; long columns; eccentrically loaded columns; eccentric connections; analysis of special details; erection methods and costs. *Three times a week; both semesters. One unit or more.* Assistant Professor Wilson.

THE CLASSICS

The Degree of Master of Arts in the Classics.—The major may be either Latin or Greek, but every candidate for a degree should take work in both languages.

Before the period of the regular course examinations of the second semester, each candidate must also pass two examinations which are to be regarded as tests of attainment rather than as a requirement of special or additional preparation. The first examination consists of written translation at sight, from the candidate's major language, of passages equivalent in difficulty to the work of first-year graduate courses. The second examination is oral and is designed to determine the candidate's general ability and his advancement in the various fields of classical philology, especially those treated in course 110, Bibliography and Criticism.

The Degree of Doctor of Philosophy in the Classics.—The degree is given in classical philology. Major work may be taken in either Latin or Greek, but whichever language is taken as a major, the other must be taken as the first minor.

Greek

Preparation for first-year graduate work in Greek must include at least two years of college Greek in addition to entrance requirements and three years of college Latin. A reading knowledge of French or German, preferably the latter, is highly desirable for candidates in this subject. The study of history and philosophy is especially recommended.

Courses for Graduates

104. Homer and the Homeric Question.—*Twice a week; both semesters. One unit* Professor Oldfather.

[Alternates with 105. Not given in 1915-1916.]

105. Plato and Aristotle.—*Twice a week; both semesters. One unit.* Professor Oldfather.

108. Greek Drama.—*Twice a week; both semesters. One unit.* Professor Moss.

[Alternates with 107. Not given in 1915-16.]

107. Greek Oratory.—Speeches of several orators are read rapidly, and a detailed study made of one or two authors. Individual study and report on assigned topics. *Twice a week; both semesters. One unit.* Professor Moss.

Courses for Graduates and Advanced Undergraduates

(For minor credit only)

5. Herodotus: The Lyric Poets.—Selections. *Three times a week; second semester.* Professor Moss.

[Alternates with 7. Not given in 1915-16.]

6. Thucydides.—Books VI-VII. *Three times a week; first semester.* Professor Pease.

7. The Drama.—*Three times a week; second semester.* Professor Moss.

8. Plato.—Selected Dialogues, including Phaedo; the Apology.

Three times a week; first semester. Professor Pease.
[Alternates with 6. Not given in 1915-16.]

Latin

Preparation for first year graduate work in Latin must include at least three years of college Latin in addition to entrance requirements. A reading knowledge of French or German, preferably the latter, is highly desirable. Some acquaintance with Greek is indispensable, and the study of history and philosophy is especially recommended.

Courses for Graduates

102. Roman Oratory.—The subject is studied in its development as a department of literature, with special reference to the Ciceronian period. *Twice a week; second semester. One unit.*
Assistant Professor Canter.

103. Cicero.—The De Natura Deorum and the De Divinatione. The Epicurean, Stoic, and Academic theories of religion and their relation to the popular worship. *Twice a week; first semester. One unit.* Professor Pease.

104. Latin Palaeography.—Lectures on the material and form of ancient books, the methods of copying, and the common errors in manuscripts. A study of the facsimiles of codices, and practice in text criticism. *Twice a week; first semester. One unit.*
Professor Pease.

106. Terence.—The comedies are read and two or three plays interpreted. Lectures on literary history and the syntax of early Latin. *Twice a week; first semester. One unit.*
Professor Oldfather.

107. Latin Epigraphy.—The purpose of this course is to familiarize the student with the forms and language of inscriptions and to read selections from those in the Corpus Inscriptionum Latinarum. *Twice a week; second semester. One-half to one unit.*
Professor Pease.

108. Tacitus.—The Histories. Emphasis is placed on political and social conditions. *Twice a week; first semester. One unit.*
Professor Barton.

109. Virgil.—The life and works of Virgil, with study of his sources and of his influence upon later literature. *Twice a week; second semester. One unit.* Professor Pease.

112. Roman Historiography.—*Twice a week; second semester. One unit.* Assistant Professor Canter.

[Alternates with 102. Not given in 1915-16.]

113. Plautus. Six comedies are read and two or three interpreted. *Twice a week; first semester. One unit.*

Professor Oldfather.

[Alternates with 106. Not given in 1915-16.]

114. Caesar.—The historical works, especially the Bellum Gallicum. *Twice a week; second semester. One unit.*

Professor Oldfather.

Courses for Graduates and Advanced Undergraduates

7. Satire.—Selected Satires and Epistles of Horace and selected Satires of Juvenal. *Three times a week; first semester.*

Professor Pease.

[Alternates with 8. Not given in 1915-16.]

8. Tacitus.—The Annals. Books I-VI. *Three times a week; first semester.* Professor Pease.

14. Seneca.—Selections from his letters and tragedies. *Three times a week; second semester.* Professor Barton.

[Alternates with 16. Not given in 1915-16.]

16. Martial and Suetonius.—Selections; lectures on literary history. *Three times a week; second semester.*

Professor Oldfather.

22. Late Latin.—Rapid reading of selections from Latin writers from Minicius Felix to Cassiodorus. *Twice a week; second semester.* Professor Pease.

Classical Philology

110. Bibliography and Criticism.—This course is designed to make clear the aims and methods of Classical Philology.

All graduate students who are taking Latin or Greek as a major for the master's degree must take this course unless they have already completed it or its equivalent. *Once a week; both semesters. One-quarter unit.*

Professors Oldfather, Pease, and others.

Attention is also called to Comparative Philology 2,—Comparative Philology of the Indo-European Languages. *Twice a week; second semester.* Assistant Professor Bloomfield.

DAIRY HUSBANDRY

The prerequisite for major work in Dairy Bacteriology is fifteen semester hours in bacteriology, together with a proper training in chemistry and other subjects leading logically up to the study of Bacteriology. The requirement for minor standing is five semester hours in Bacteriology with accompanying prerequisites.

In Dairy Production the prerequisite for graduate standing in major work for a master's degree is thirteen hours of undergraduate work in Dairy Husbandry and for minor work for the master's degree eight semester hours of undergraduate work in Dairy Husbandry.

Courses for Graduates

101. Economic Milk Production.—A study of differences in the efficiency of dairy cows, cause and effect of the same, and the relation they bear to successful dairy farming. *Twice a week; both semesters. One unit.* Professor Fraser.

[Not given in 1915-16.]

102. Research.—A study of the investigations in progress in the dairy herds of the State. *Twice a week; both semesters. One unit.* Professor Fraser.

[Not given in 1915-16.]

103. Research.—Dairy feeding problems. *Twice a week; both semesters. One unit.* Professor Fraser.

[Not given in 1915-16.]

104. Dairy Bacteriology.—Lecture and research on assigned topics. *Twice a week; both semesters. Two units.*

Professor Harding, Assistant Professor Prucha.

Courses for Graduates and Advanced Undergraduates

7. Creamery Buttermaking and Factory Management.—*Six times a week; second semester.*

Assistant Professor Hepburn, Mr. Lang.

11. Dairy Bacteriology.—General survey of the bacteria of milk and its products from the udder to the consumer, giving attention to their methods of introduction, their effect upon the milk and methods for their control. *Twice a week; first semester.*

Professor Harding.

12a-12b. Laboratory work supplementing Dairy Husbandry 11. *Four times a week; both semesters.*

Professor HARDING, Mr. ALLEN.

21. ECONOMIC MILK PRODUCTION.—*Five times a week; second semester.* Professor FRASER.

[Not given in 1915-16.]

ECONOMICS

Every student entering upon graduate work in economics must have had a course in the principles of the science and also in some special part of the field, such as public finance or money and banking. The work must represent at least eight semester hours.

Graduate students who are making economics their major are required during their first year to acquaint themselves with the works of the masters in the science, either by taking course 101 or by private reading for examination. In the second or third year they are expected to elect courses 105 and 120, and some fundamental course in political science and sociology (either course 11 or 102 in sociology, and political science 101 and 102) unless they have already had such courses.

The following courses may be taken by students in general economics for major or minor credit: all numbered above 100; 4, 5, 10, 12, 13, 19, 20, 21, 29, 51. The following may be taken for minor credit only: 8, 9, 14, 15, 17, 28, 31.

Two units will be accepted for a first minor for the master's degree; and four two or three hour· graduate courses, or their equivalent in advanced undergraduate courses, for a first minor for the doctor's degree.

Courses for Graduates

101. ECONOMIC THEORY.—*Twice a week; both semesters. One unit.* Professor KINLEY.

[Not given in 1915-16.]

102. THEORY OF MONEY, CREDIT AND PRICES.—*Twice a week; both semesters. One unit.* Professor KINLEY.

104. FOREIGN AND COLONIAL TRADE OF THE UNITED STATES.—*Twice a week; second semester. One unit.*

Assistant Professor LITMAN.

105. Public Finance.—*Twice a week; both semesters. One unit.* Professor Bogart.

107. The Corporation in Economic Evolution.—*Twice a week; first semester. Quarter unit.* Professor Robinson.

109. Theory of Industrial Consolidations.—*Twice a week; second semester. Half unit.* Professor Robinson.
[Not given in 1915-16.]

118. Seminar.—The Seminar meets weekly for the discussion of the results of students' investigations, etc.
Members of the Staff.

120. History of Economic Thought.—*Twice a week; both semesters. One unit.* Dr. J. G. Thompson.

122. Advanced Economic History of the United States.—*Twice a week; both semesters. One unit.* Professor Bogart.

Theory of Statistics. See Mathematics 129.

Courses for Graduates and Advanced Undergraduates.

4. Financial History of the United States.—*Three times a week; first semester.* Assistant Professor Weston.

5. Public Finance.—Public debts, revenue, taxation, etc. *Three times a week; first semester.* Professor Bogart.

8. The Money Market.—*Twice a week; second semester.* Assistant Professor Weston.

9. Practical Banking.—*Twice a week; first semester.* Assistant Professor Weston.

10. Corporation Management and Finance.—*Three times a week; first semester.* Professor Robinson.

11. Industrial Consolidation.—The development of industrial consolidations; plans for controlling trusts, etc. *Three times a week; second semester.* Professor Robinson.

12. Labor Problems.—*Three times a week; both semesters.* Assistant Professor Heilman.

13. Economic Development of Europe Since the Industrial Revolution.—*Three times a week; second semester.* Professor Bogart.

14. Agricultural Cooperation.—A study of the organization, financing, and management of cooperative associations for the promotion of various branches of farming. *Twice a week; second semester.* Dr. Stewart.

15. Rural Credit.—A study of the credit and banking needs of rural communities and of the ways and means of supplying them. *Twice a week; first semester.* Dr. Stewart.

17. Economic History of Agriculture.—General characteristics of agriculture, and its development as an industry in various countries at various times. State of the agricultural class. Relation of agriculture to other industries. Relation of the state to agriculture. *Twice a week; second semester.* Dr. J. G. Thompson.

19. United States Industry, 1820-1860.—*Twice a week; first semester.* Dr. C. M. Thompson.

20. United States Industry Since 1860.—*Twice a week; second semester.* Dr. C. M. Thompson.

21. Socialism and Economic Reform.—*Twice a week; second semester.* Assistant Professor Heilman.

28. Mechanism and Technique of Domestic Commerce.—*Three times a week; first semester.* Assistant Professor Litman.

29. Foreign Commerce and Commercial Politics.—*Three times a week; second semester.* Assistant Professor Litman.

31. Organization of Foreign Commerce.—A study of exporting and importing; means of communication and of transportation; the shipping business; duties of consuls. *Three times a week; second semester.* Assistant Professor Litman.

[Not given in 1915-16.]

51. Public Utilities.—Relations of the public to public service corporations; methods of regulation, etc. *Three times a week; first semester.* Assistant Professor Heilman.

EDUCATION

Students who elect education as a major subject must have completed at least a three-hour course in the principles of education, a course of at least the same length in the history of education, and a minimum of three hours each in psychology and philosophy. For graduate students who have had experience in teaching, these requirements may be modified.

Courses for Graduates

101. Seminar in Educational Theory.—The general topic for 1915-16 is the higher thought processes in their relation to the

philosophy of education. *Once a week; first semester. One unit.* Professor BAGLEY, Professor BODE.

105. SEMINAR IN HISTORY OF EDUCATION.—[Not given in 1915-16.]

106. SEMINAR IN SECONDARY EDUCATION.—Organization, administration, and special methods of secondary education. *Once a week; second semester. One unit.*

108. THE HISTORY OF VOCATIONAL AND INDUSTRIAL EDUCATION. [Not given in 1915-16.] *Second semester. One unit.*

104. SEMINAR IN ADMINISTRATION AND SUPERVISION.—[Not given in 1915-16.] *Once a week; second semester. One unit.*

112. PRINCIPLES OF EDUCATION.—A course for graduate students who are not majoring in education and who have not taken undergraduate courses in education. The course involves: (1) a brief survey of the American public-school system; (2) a statement of the leading principles and doctrines of educational science; and (3) a brief reference to the technique of teaching and the problems of class management. All graduate students who expect to teach are urged to take this course if they have not had previous training in Education or experience in teaching. *Twice a week; second semester. Half unit.* Professor BAGLEY.

119. THE ELEMENTARY CURRICULUM.—*Twice a week; second semester. One unit.* Associate Professor BROWN.

125. SEMINAR IN EDUCATIONAL PSYCHOLOGY.—*Once a week; first semester. One unit.* Professor WHIPPLE.

DEPARTMENTAL CONFERENCE.—Every alternate Monday from 7 to 9 P. M. All graduate students majoring in education are expected to meet with the departmental staff at this time. The work carries no credit. *First and second semesters.*

Courses for Graduates and Advanced Undergraduates

4. PROBLEMS OF EDUCATIONAL ADMINISTRATION.—The interpretation of present tendencies. *Three times a week; first semester.* Associate Professor BROWN.

5. COMPARATIVE EDUCATION.—A comparative study of the educational organization, administration, and basic national ideals of the schools and school systems of the United States, Germany, England, and France, with particular reference to secondary education and to the training of teachers. *Three times a week; first semester.* Professor JOHNSTON.

13-14. Educational Classics.—A detailed study of the principal educational writings of Plato, Aristotle, Quintilian, Montaigne, Vittorino, Da Feltre, Milton, Locke, Comenius, Rousseau, Pestalozzi, Froebel, and Herbert Spencer. *Three times a week; first and second semesters.*

Professor Whipple, Associate Professor Brown.

15. School Hygiene.—*Twice a week; second semester.*

Professor Whipple.

18. Method in Educational Research.—*Twice a week; first semester.* Associate Professor Brown.

20a. Theory of Supervision.—*Three times a week; second semester.* Professor Bagley.

27. High-School Curriculums.—*Three times a week; second semester.* Professor Johnston.

41. Vocational Education.—*Three times a week; first semester.* Professor Johnston.

42. Auxiliary Education.—The institutions and methods involved in the training of defectives and delinquents; the Binet-Simon tests and other methods of mental diagnosis; educational treatment of morons and of moral delinquents; an outline of the methods of teaching sensory defectives (the blind and the deaf); public institutions of auxiliary education and their administration. *Three times a week; second semester.* Professor Whipple.

43. Mental Tests.—Laboratory drill in the technique of mental tests, including tests of sensory capacities; attention; memory; learning; suggestibility; inventiveness; systems of tests for diagnosis of mental age, general intellectual status, mental retardation, etc. *Twice a week; second semester.* Professor Whipple.

45. Research Problems in Educational Psychology.—*First or second semester.* Professor Whipple.

ELECTRICAL ENGINEERING

The prerequisite for graduate work in electrical engineering is the equivalent of the undergraduate courses required for the degree of Bachelor of Science in electrical engineering in the branches of the subject in which registration is desired.

Graduate students who wish to take a minor in electrical engineering must have had differential and integral calculus, and one year's work in college physics.

Courses for Graduates

101. Advanced Course in Alternating Currents.—The Theory of Transient Phenomena; polyphase circuits; measuring apparatus. *Twice a week; both semesters. One and one-half units.*
Professor Paine.

103. Electrical Design.—Plans for an electrical machine or apparatus of specified character; or for the arrangement of an electrical plant; or for the installation of such machinery or apparatus. *Twice a week; second semester. One unit.*
Assistant Professor Waldo.

104. Telegraphy and Telephony.—Telegraph apparatus and methods including quadruplex systems and high speed telegraphy. Manual and automatic telephone systems. *Once a week; both semesters. One unit.* Professor Brooks.

105. Electrical Engineering Research.—Investigation of electrical phenomena, or tests of some electrical machine, or of a plant of such machines. *Twice a week; both semesters. One to three units.* Professor Paine.

106. Illumination.—The investigation of problems in illumination. A study of the various light sources. *Once a week; both semesters. One unit.* Professor Brooks.

Courses for Graduates and Advanced Undergraduates

14. Alternating Currents.—*Four times a week; first semester.*
Professor Paine, Mr. Fisk and Mr. James.

17. Advanced Alternating Currents.—*Four times a week; second semester.*
Professor Paine, Mr. Fisk and Mr. James.

27. Electrical Engineering Laboratory.—*Twice a week; second semester.* Assistant Professor Biegler.

ENGLISH LANGUAGE AND LITERATURE

Students who enter upon graduate work with English as their major subject are required to give evidence of their ability to write good English. They must present the equivalent of fourteen hours of undergraduate work in English literature, the required college work in rhetoric, and the equivalent of four semesters of college work in a language other than English. After the first year of graduate work a knowledge of French and German is indispensable.

Students making English their minor may be admitted to such courses as in the judgment of the instructor in charge they are qualified to pursue.

The Degree of Master of Arts in English.—In addition to complying with the general rules of the Graduate School, candidates for the degree of Master of Arts in English must comply with the following rules of the Department of English: (1) they must choose a portion of their work from the group of courses described as "for graduates;" (2) must offer an elementary course in Anglo-Saxon; and (3) must take, besides the regular semester examinations in all their courses, a general examination, oral or written as the department may prescribe, which shall be a final test of the candidate's fitness and ability.

The Degree of Doctor of Philosophy in English.—Candidates for the degree of Doctor of Philosophy in English may expect to be examined on the entire field of the English language and literature. They are urged, furthermore, to acquaint themselves as fully as possible with the history and the philosophy of the period in which their main interest lies, and with the foreign languages and literature most closely related to English in that period.

Courses for Graduates

101. RESEARCH IN SPECIAL PERIODS.—Competent graduate students are encouraged to seek the advice and assistance of the Department of English and to submit to the Department plans for study in the language or literature of the periods mentioned below.

A. Anglo-Saxon Language and Literature.
Professor DODGE and Dr. ZEITLIN.

B. Thirteenth and Fourteenth Centuries.
Assistant Professor JONES.

C. Sixteenth Century. Professor DODGE.

D. Seventeenth Century. Assistant Professor BALDWIN.

E. Eighteenth Century.
Professor SHERMAN, Assistant Professor PAUL.

F. Nineteenth Century.
Professor SHERMAN, Associate Professor FULTON.

106. ENGLISH LITERARY CRITICISM FROM DRYDEN TO COLERIDGE.—*Twice a week; both semesters. One unit.*
Associate Professor FULTON.

108. The English Epic in the Sixteenth, Seventeenth, and Eighteenth Centuries from the Point of View of Classical Theory.—*Twice a week; both semesters. One unit.*
Associate Professor Fulton.

[Not given in 1915-16.]

109. German and Scandinavian Influences on English Literature of the Eighteenth and Nineteenth Centuries.—*Twice a week; first semester. One unit.* Professor Dodge.

[Not given in 1915-16.]

110. Old English (Anglo-Saxon) Poetry. *Twice a week; first semester. One unit.* Professor Dodge.

113. Historical Prose Syntax.—The forces, native and foreign, at work in the development of English prose style as far as it relates to sentence structure. *Twice a week; both semesters. One unit.* Dr. Zeitlin.

[Not given in 1915-16.]

114. The Development of the Essay.—An examination of the various types of the English essay with reference to continental influences and classical origins. *Twice a week; both semesters. One unit.* Dr. Zeitlin.

126. Ballads and Metrical Romances.—*Twice a week; both semesters. One unit.* Assistant Professor Jones.

[Not given in 1915-16.]

127. Middle English.—Critical reading of Middle English texts. Assistant Professor Jones.

[Not given in 1915-16.]

128. Spenser and the Beginnings of the English Renaissance.—Special emphasis upon the persistence of certain mediaeval traditions reinforced by the Revival of Classical Learning. Consideration of Catholicism and Calvinism as sources of literary inspiration. *Twice a week; both semesters. One unit.*
Assistant Professor Jones.

135. Problems in American Literature.—*Twice a week; both semesters. One unit.* Assistant Professor Paul.

[Not given in 1915-16.]

136. The Transition from the Seventeenth to the Eighteenth Century: The Rise of Classicism. *Twice a week; both semesters. One unit.* Assistant Professor Paul.

137. Prose Writers of the Nineteenth Century.—Studies in the relation of literature to social forces, with special attention to the works of Mill, Carlyle, Newman, Ruskin, Arnold, and Pater. *Twice a week; both semesters. One unit.* Professor Sherman.

[Not given in 1915-16.]

138. The Romantic Movement in England.—*Twice a week; both semesters. One unit.* Professor Sherman.

150. Old Irish.—Selections from the Tain bo Cualnge and the romances; lectures on Old and Middle Irish literature. *Twice a week; first semester. One unit.* Dr. Schoepperle.

[Not given in 1915-16.]

Courses for Graduates and Advanced Undergraduates

A. Literature and Language

3. The Poetry of Milton.—Origins, forms, artistic and ethical values; Milton's place in English literary history. *Twice a week; second semester.* Assistant Professor Baldwin.

4. English Versification.—Theory of English rhythm and metre; history of the development of the forms of English verse. *Three times a week; first semester.* Dr. Creek.

5. Shakespeare.—Intensive study of a few plays, with special emphasis on *Hamlet. Three times a week; second semester.* Professor Dodge.

8-9. Old English (Anglo-Saxon).—Grammar; prose; short poems; *Beowulf.* (The first semester may be taken separately.) *Three times a week; both semesters.* Professor Dodge.

18. Modern English Grammar.—The structure of the sentence and its analysis into the parts of speech; the common grammatical categories; the peculiarities of English syntax. *Three times a week; second semester.* Dr. Zeitlin.

25-26. Chaucer and His Contemporaries.—(The first semester, devoted wholly to Chaucer, may be taken separately.) *Three times a week; both semesters.* Assistant Professor Jones.

27-28. Studies in the History of Journalism.—First semester: English Literary Periodicals and the Periodical Essay in the 18th Century. Second semester: The Magazine in America. *Twice a week; both semesters.* Assistant Professor Scott.

35-36. English Drama (exclusive of Shakespeare.)—A. (first semester), From the beginning to 1600; B. (second semester),

From 1660 to 1700. (Either semester may be taken separately.) *Three times a week; both semesters.*

Professor Dodge, Professor Sherman.

38. The Arthurian Tradition in England.—Primitive elements; the historical Arthur; Celtic, French, and Italian influences; the tradition in England from the early romances to Arnold. *Three times a week; second semester.* Dr. Schoepperle.

39. Introduction to the Literature of the Middle Ages.—The relations of English and continental literature to the fourteenth century. *Three times a week; first semester.* Dr. Creek.

[Not given in 1915-16.]

41-42. Teachers' Course.—Methods of teaching English literature and composition in the high school. (Either semester may be taken separately. This course, while open to graduate students, is not credited toward advanced degrees.) *Twice a week; both semesters.*

45. The Development of the Modern Drama.—Dramatic tendencies in the Eighteenth and Nineteenth centuries, both in England and on the Continent; representative readings, and lectures from the standpoint of comparative literature. *Twice a week; both semesters.*

50. Celtic Literature and Civilization.—An introduction to the study of the Celtic literature and civilization. No knowledge of Celtic languages required. *Twice a week; first semester.*

Dr. Schoepperle.

B. Rhetoric

15-16. Advanced Newspaper Writing.—The larger problems in reporting; application of principles of history, economics, and political science to current public events; editing; editorial writing. *Three times a week; both semesters.*

Assistant Professor Scott.

17. Advanced Composition.—Practice writing, with special emphasis on the study of structure; criticism of current periodical literature; the development of material for reports, magazine articles, etc. (Open to a limited number of students, and only on recommendation.) *Three times a week; second semester.*

Dr. Whicher.

ENTOMOLOGY

The prerequisite for graduate work in entomology is one year's work in biological courses, including the equivalent of either Zoology 1 or Entomology 1 or 4. Entrance upon major work in entomology requires the equivalent of Entomology 2, 3, or 15.

Students are offered an opportunity for work in insect morphology, systematic entomology, and ecological and economic entomology.

Courses for Graduates

102. Research in the Morphology and Embryology of Insects.—*Twice a week; both semesters. One or two units.*
Assistant Professor Folsom.

107. Systematic Entomology.—*Five times a week; both semesters. One or two units.* Assistant Professor MacGillivray.

108. Research in Economic Entomology.—*Once or twice a week; both semesters. One or two units.*
Professor Forbes and Assistant Professor Folsom.

109. Research in Systematic Entomology.—*Five times a week; both semesters. One or two units.*
Associate Professor MacGillivray.

Courses for Graduates and Advanced Undergraduates

2. General Entomology.—This course and course 3 form a year's work, covering the whole field. Either may be taken independently of the other. *Five times a week; first semester.*
Assistant Professor Folsom.

3. General Entomology.—*Five times a week; second semester.*
Assistant Professor Folsom.

8. Economic Entomology.—Field, laboratory, insectary, library, and manuscript work, with practice in some of the special operations of economic entomology. *Three times a week; both semesters.* Assistant Professor Folsom.

10. Taxonomy of Immature Insects.—A study of the external form of immature insects and the identification of as many species as possible. *Five times a week; first semester.*
Associate Professor MacGillivray.

11. Classification of the Coccidae.—Methods of preparing scale insects for study, the identification of genera and species, and

discussion of their morphology, metamorphosis, and phylogeny. *Five times a week; second semester.*

Associate Professor MacGillivray.

12. Current Literature.—*Once a week; both semesters.*

13. Medical Entomology.—Primarily for advanced students preparing for medicine. A study of insects as related to the transmission of disease. *Three times a week; first or second semester.*

Assistant Professor Folsom.

14. Advanced Economic Entomology.—Personal work, under direction, in the insectary, field, and library, with assigned problems in economic entomology, involving observation, experiment, and inference, note making, record keeping, and the preparation of manuscript. *Twice a week; first or second semester, and six weeks of summer vacation.*

Professor Forbes and Assistant Professor Folsom.

FRENCH

See Romance Languages.

GEOLOGY

The first prerequisite for graduate work in Geology is the equivalent of the complete undergraduate offerings in that branch of the subject in which specialization is desired. Those who wish to specialize in paleontology should have, in addition, at least an elementary knowledge of systematic zoology; those who wish physical geography should have a fairly thorough knowledge of general physics and chemistry; and those who expect to pursue work in petrography and economic geology should be well grounded in general physics, inorganic chemistry and the elements of physical chemistry. All graduate students should be sufficiently acquainted with German and French to be able to read the journals printed in these languages.

Courses for Graduates

101. Advanced Crystallography.—This course deals with the methods used in measuring, prospecting and calculating crystal forms, and determining the physical properties of crystallized bodies. *Three to five times a week; both semesters. One unit.*

Professor Bayley.

103. The Crystalline Schists and Other Metamorphic Rocks; Processes of Metamorphism.—*Twice a week; both semesters. One unit.* Professor Bayley.

105. Invertebrate Paleontology.—A course devoted to the study of a group of invertebrate fossils, or of the fossils of a special geological system. Largely individual work. *One to three times a week; both semesters. One unit.*

Associate Professor Savage.

106. Areal and Stratigraphic Geology.—A systematic study of the geology and paleontology of a selected area in Illinois. *One to three times a week; both semesters. One to two units.*

Associate Professor Savage.

108. Advanced Economic Geology.—The processes resulting in the production of ore-bodies. Studies of type mining districts. *Three times a week; both semesters. One to two units.*

Professor Bayley.

124. Advanced Physiography.—Individual work on field problems; discussion of the literature. *One to three times a week; both semesters. One unit.* Dr. Rich.

Courses for Graduates and Advanced Undergraduates

6. Physical and Optical Mineralogy.—An introduction to the courses in petrography. *Three times a week; first semester.*

Professor Bayley.

7. Petrography.—The principles learned in course 6 are applied to the study of rocks. *Three times a week; second semester.*

Professor Bayley.

9. Paleontology.—A study of invertebrate fossils, their classification and relationships. *Five times a week; first semester.*

Associate Professor Savage.

15. Structural Geology.—*Three times a week; first semester.*

Dr. Van Tuyl.

16. Stratigraphy.—This course follows course 9, and is a study of principles of classification, of rock formations, of the methods and criteria employed in correlation of the successive geologic formations. *Five times a week; second semester.*

Associate Professor Savage.

17. Principles of Stratigraphy.—Sedimentary rocks and as-

sociated deposits; kinds; composition; origin, mode of occurrence; geologic interpretation. *Five times a week; first semester.*

Associate Professor SAVAGE.

24. PHYSIOGRAPHIC INTERPRETATIONS.—The application of physiographic principles to the interpretation of recent earth history; erosion planes; drainage modifications; physiographic indications of climatic fluctuations. *Three times a week; first semester.*

Dr. RICH.

25. PHYSIOGRAPHY OF THE MISSISSIPPI VALLEY.—The physiography of the Mississippi Valley, with field trips to southern Illinois, eastern Missouri, the Baraboo Ridges of Wisconsin, or the Lexington dome of Kentucky. *Three times a week; second semester.*

Dr. RICH.

GERMANIC LANGUAGES AND LITERATURES

GERMAN

Students desiring to take German as a major are required to have finished successfully a four years' course of undergraduate work in German, comprising a minimum of twenty-eight semester hours of credit. They are also required to be familiar with the principal works of the writers of the classical and modern periods of German literature, to show a general knowledge of the history of German literature and to be able to follow lectures in the German language.

Of collateral subjects, a reading knowledge of Latin and French is required. It is desirable that candidates for the degree of Ph.D. have some knowledge of Greek. All students are to have had a course in German history.

Courses for Graduates

101. SEMINAR IN GERMANIC PHILOLOGY.—The primary object is to give training in original research. The result of the work, when of value, may be published in the *Journal of English and Germanic Philology. Once a week; both semesters. One unit.*

Professor GOEBEL.

103. INTRODUCTION TO THE HISTORICAL STUDY OF THE GERMANIC LANGUAGES.—History of German Philology. Comparative Gram-

mar of the Old Germanic dialects. *Twice a week; second semester. One unit.* Professor GOEBEL.

104. GOTHIC.—An introductory study of its grammar and literature. *Twice a week; first semester. One unit.* Professor GOEBEL.

105. OLD HIGH GERMAN.—Grammar and interpretation of the oldest literary documents. *Three times a week; first semester. One unit.* Dr. GREEN.

[Not given in 1915-16.]

109. GOETHE'S AND SCHILLER'S PHILOSOPHY.—*Twice a week; both semesters. One unit.* Professor GOEBEL.

[Not given in 1915-16.]

110. EARLY GERMAN DRAMA.—The development of the German drama up to the Reformation, including the medieval religious drama, the Shrovetide plays and the beginnings of the Humanistic drama. *Twice a week; first semester. One unit.* Assistant Professor BROOKS.

113. GERMAN LITERATURE OF THE FIFTEENTH AND SIXTEENTH CENTURIES.—Survey of the literature on the background of the general history of the time. Luther and the Reformation, Mastersingers and Folksong, the Reformation drama. Hans Sachs, Brant, Fischart, the chap books, the English comedians. *Twice a week; second semester. One unit.* Assistant Professor BROOKS.

115. HISTORY OF GERMAN LITERATURE FROM GOETHE'S DEATH TO THE PRESENT TIME.—*Twice a week; both semesters. One unit.* Professor LESSING.

116. MEDIEVAL GERMAN LITERATURE WITH REFERENCE TO POLITICAL, RELIGIOUS, AND SOCIAL HISTORY.—Research course. *Twice a week; both semesters. One unit.* Professor LESSING.

[Not given in 1915-16.]

117. HISTORY OF GERMAN LITERATURE DURING THE EIGHTEENTH CENTURY.—*Twice a week; both semesters. One unit.* Professor GOEBEL.

118. THE GERMAN DRAMA SINCE SCHILLER.—Research course. *Twice a week; both semesters. One unit.* Professor LESSING.

[Not given in 1915-16.]

119. THE GERMAN NOVEL.—Research course. *Twice a week; both semesters. One unit.* Professor LESSING.

121. Walther von der Vogelweide.—Lectures and interpretations. *Twice a week; second semester. One unit.*

Professor Goebel.

124. History of the Drama.—The beginnings of the drama and its development in the eighteenth century. *Twice a week; first semester. One unit.*

[Not given in 1915-16.]

125. History of the German Language.—Historical and critical study of the evolution of the forms, syntax and lexicography of the High German literary language. *Three times a week; second semester. One unit.* Dr. Green.

Courses for Graduates and Advanced Undergraduates

8. Schiller.—The life of Schiller; *Wallenstein* and other selections. *Three times a week; first semester.*

Professor Lessing.

19a-19b. Goethe's Faust.—The Faust legend and early Faust books and plays; the genesis of Goethe's *Faust;* reading of both parts. *Twice a week; both semesters.* Professor Goebel.

39a-39b. Goethe-Schiller.—Interpretation of Goethe's poems. Goethe's *Tasso* and Schiller's *Ueber naive und sentimentalische Dichtung. Twice a week; both semesters.* Professor Goebel.

[Not given in 1915-16.]

11. German Literature after the Reformation.—Lectures; recitations; reports on assigned reading. *Three times a week; second semester.* Professor Lessing.

25. Teachers' Course.—Discussion of methods; examination of text-books. *Twice a week; second semester.*

Assistant Professor Brooks.

26. German Literature before the Reformation.—Lectures; recitations; reports on assigned readings. *Three times a week; first semester.* Professor Lessing.

27. Lessing.—The life of Lessing; *Nathan der Weise, Emilia Gallotti* and other selections. *Three times a week; second semester.* Professor Lessing.

[Not given in 1915-16.]

29. Advanced Prose Composition.—Themes on Germany and German life, based on suitable reading, discussed in German. *Three times a week; both semesters.* Ar. Koller.

31. Middle High German.—Grammar and readings. *Twice a week; first semester.* Professor Goebel.

32. History of German Civilization.—Readings; lectures; discussions. *Three times a week; first semester.* Assistant Professor Brooks.

The Scandinavian Languages

Preparation for major graduate work in the Scandinavian languages or literature must include a good reading knowledge of one of the Scandinavian languages and systematic work in the undergraduate courses in Scandinavian. Any graduate student in language may, however, be admitted to the purely philological courses.

Courses for Graduates

101. Old Norse.—Introduction to the language as a member of the Germanic group. Reading of the *Prose Edda* with selections from the Kings' Sagas. *Twice a week; both semesters. One unit.* Associate Professor Flom.

110. Advanced Old Norse.—Critical Study of the lays of the *Elder Edda* and selections from the *Speculum Regale (Konungs Skuggsjá). Twice a week; both semesters. One unit.* Associate Professor Flom.

[Not given in 1915-16.]

140. Early Scandinavian Paleography.—Lectures and practical work with the oldest manuscripts. The work is based on the facsimiles and photographs of manuscripts in the Scandinavian Collection of the University library. *Twice a week; second semester. One unit.* Associate Professor Flom.

[To be given in 1916-1917.]

150. Research.—Special problems in Scandinavian philology or literature. *Twice a week; first semester. One unit.* Associate Professor Flom.

Courses for Graduates and Advanced Undergraduates

14. History of Old Norse Literature.—Lectures. *Twice a week; second semester.* Associate Professor Flom.

[Not given in 1915-16.]

16. Survey of Early Scandinavian Culture.—Lectures on the civilization of Scandinavia from the Stone Age down to 1000 A. D. *Twice a week; second semester.*

Associate Professor Flom.

[To be given in 1916-1917.]

Comparative Philology

For Graduates and Advanced Undergraduates

1. Introduction to the Study of Language.—Phonetics; the development of forms of speech; dialects and the spread of languages; the study and teaching of language. *First semester; three times a week.* Assistant Professor Bloomfield.

2. Comparative Philology of the Indo-European Languages.—Greek, Latin, and the Germanic languages, including English. *Second semester; twice a week.* Assistant Professor Bloomfield.

3. Elementary Sanskrit.—Reading and grammar. *First semester; three times a week.* Assistant Professor Bloomfield.

4. Elementary Sanskrit.—Continuation of 3. *Second semester; three times a week.* Assistant Professor Bloomfield.

GREEK

[See Classics.]

HISTORY

Graduate work in history requires two years of college work in this subject, or sixteen semester hours, which should ordinarily include introductory courses in European and American history corresponding roughly to History 1 and 3 in this University. Linguistic preparation is important especially in French and German history. For medieval history some knowledge of Latin is essential, and Spanish is useful for certain fields of American history.

Advanced courses in history at the University of Illinois are of three kinds: (1) Courses for information and guidance in general reading. (2) Instruction in methodology, histroriography, and bibliography. A part of this work (in course 103) is required of

all graduate students in history during their first year. (3) Seminary courses for the study of special fields with a view primarily to training in the methods of historical criticism and research.

Illinois Survey.—Historical students have an opportunity to pursue research in western history in connection with the Illinois Survey, which is an organization for the purpose of carrying on systematic studies in the history of Illinois.

Attention is also called to the fact that the University of Illinois has for some time co-operated with the Illinois State Historical Society and the Trustees of the State Historical Library, in the gathering and editing of archive material. As a result of this relation instructors and graduate students in the department have contributed from time to time to the publications of these state organizations and have been given useful training in the study of manuscript as well as printed material.

HIGHER DEGREES IN HISTORY

The following statement regarding the specific requirements for higher degrees in History is subject to the general requirements of the Graduate School.

Master of Arts

In addition to meeting the general tests in the specific courses taken, each candidate is required to pass a general oral examination, and written examinations in two of the following fields: Ancient History; Medieval History of Continental Europe; Modern History of Continental Europe; English History; American History. Candidates for this degree are expected to have a general knowledge of historical bibliography and methodology (see course 103).

Doctor of Philosophy

Major Requirements.—A candidate who selects history as his major subject may offer himself for examination in any four of the fields indicated below, stating also the particular field among these four in which he wishes to specialize and in which his thesis is to be written:

1. Ancient history (with special reference to Greece and

Rome). 2. Medieval history and institutions of continental Europe, to the close of the thirteenth century. 3. Continental Europe from 1300 to 1648. 4. Continental Europe and its dependencies since 1648 (except as included in 5 and 6). 5. The History of England and its dependencies (not including America before 1783). 6. American history (except as included in 5, and with primary reference to the United States). This enumeration of fields is not to be regarded as excluding the possibility of accepting others as may be determined by the Department in individual cases.

MINOR SUBJECTS.—A candidate for the doctorate in history may select as his first minor one of the divisions of the field of history listed above which is not offered as a part of his major. He should preferably, however, select his minors from subjects offered by other departments. The following list of suitable minors is intended to be suggestive rather than exhaustive or compulsory.

I. IN POLITICAL SCIENCE.—(Any two acceptable for a first minor; any one, for a second minor): 1. International law and diplomacy. 2. Modern government. 3. Municipal government. 4. Constitutional and administrative law and jurisprudence. 5. Political theory.

II. IN ECONOMICS AND SOCIOLOGY.—Any two acceptable for a first minor; any one, for a second minor: 1. Economic history. 2. Economic theory. 3. Public and private finance. 4. Social reform. 5. Principles of sociology.

III. IN PHILOSOPHY AND EDUCATION.—(Any two acceptable for a first minor; any one, for a second minor): 1. History of ancient and medieval philosophy; 2. History of modern philosophy. 3. History of education.

IV. IN LITERATURE.—Some division of the history of literature which may be either the comparative literature of a limited period or the literature of a particular country for a more extended period as may be agreed upon in each case.

Courses for Graduates

101. SEMINARY IN AMERICAN HISTORY.—Bibliography; practice in the solution of typical problems; reports on the progress of individual investigations by instructors and students. *Two hours, once a week; both semesters. One to two units.*

Professor GREENE and others.

In connection with this course, advice and direction in research are offered in various fields as follows:

A. American history before 1789. Professor GREENE.

B. American history since 1789.
Assistant Professor ROBERTSON, Dr. COLE.

C. The history of the west. Professor ALVORD.

D. American church history. Professor GREENE.

E. Latin-American history. Assistant Professor ROBERTSON.

102. STUDIES IN ENGLISH HISTORY.—Selected problems from the history of England in the later middle ages and the early modern period. *Twice a week; both semesters. One unit.*
Professor LARSON.

103. INTRODUCTION TO HISTORICAL METHOD AND HISTORIOGRAPHY.—Selected problems in various fields; studies of representative historians, including readings in French and German historical literature. Required of all candidates for an advanced degree in history who do not present evidence of similar training elsewhere. *Twice a week; both semesters. Half unit.*
Associate Professor LYBYER and others.

104. RESEARCH IN EUROPEAN HISTORY.—Advice and direction are offered by members of the department as follows:

A. Medieval history. Professor LARSON.

B. Modern history of Continental Europe.
Associate Professor LYBYER.

C. English history. Professor LARSON.

D. Renaissance and Reformation. Dr. JONES.

Both semesters. One to two units.

105. STUDIES IN THE HISTORY OF THE WEST.—The special subject for 1915-16 will be The West in American Diplomatic History, 1775-1814. *Once a week; both semesters. One unit.*
Professor ALVORD.

111. SPANISH-AMERICAN RELATIONS.—The relations of the Latin-American States with Europe and the United States. An intensive study of such topics as the Monroe Doctrine, the development of international trade, etc. *Once a week; both semesters. One-half to one unit.* Assistant Professor ROBERTSON.

112. STUDIES IN AMERICAN RELIGIOUS HISTORY.—Questions of Church and State. *Once or twice a week at the option of the instructor; both semesters. One unit.* Professor GREENE.

Courses for Graduates and Advanced Undergraduates

4. Constitutional History of England.—During the first semester the emphasis is placed on institutional origins; in the second semester particular attention is given to modern constitutional practice. *Three times a week; both semesters.*

Professor Larson.

7. The Revolutionary and Napoleonic Era in Europe.—*Three times a week; first semester.* Associate Professor Lybyer.

8. Civilization in the Middle Ages.—The religious, economic, and intellectual development of medieval society. *Twice a week; first semester.* Professor Larson.

9a-9b. European Society in the Era of the Renaissance and the Reformation.—The transition from medieval to modern ideals. *Twice a week; both semesters.* Dr. Jones.

10. The Development of American Society in the Eighteenth Century.—An introduction to the study of the American Revolution. *Three times a week; second semester.*

Professor Greene.

[Not given in 1915-16.]

12. History of Germany.—*Twice a week; both semesters.*

[Not given in 1915-16.]

14a-14b. American Constitutional History.—First semester: Political institutions at the close of the colonial era; early state constitutions and the confederation; the framing and ratification of the federal constitution. Second semester: The development of the written and unwritten constitution since 1789. *Twice a week; both semesters.*

Professor Greene, Assistant Professor Robertson.

15. The Civil War and the Reconstruction.—*Three times a week; second semester.* Dr. Cole.

16. The History of the Exploration and Colonization of the West.—First semester: The Mississippi Valley from the beginning of the Spanish explorations to the close of the War of 1812. Second semester: The development of the Mississippi Valley since 1815 and the progress of Westward expansion to the Pacific. *Twice a week; both semesters.* Professor Alvord.

20a. Europe in the Nineteenth Century from the Congress

of Vienna in 1815 to the Formation of the German Empire in 1871.—*Three times a week; first semester.*

Associate Professor Lybyer.

[Not given in 1915-16.]

20b. Europe Since 1871.—*Three times a week; second semester.* Associate Professor Lybyer.

21. The History of the United States Since the Civil War.—Historical introduction to contemporary American politics. *Twice a week; first semester.* Assistant Professor Robertson.

26. History of the Latin-American Colonies.—The political, economic, social, and intellectual life of Spain during the period of discovery. The exploration, settlement and civilization of Spanish America and the Philippines. *Three times a week; first semester.* Assistant Professor Robertson.

27. History of Latin-America from the War of Independence to the Present Time.—The national history of the leading Latin-American states with special attention to political parties, existing governments and relations with Europe and the United States. A study of the old régime in Texas, Mexico and California. *Three times a week; second semester.*

Assistant Professor Robertson.

29. The Far East.—The contact of Western nations with the Far East from the Portuguese establishments of the sixteenth century to the present time, with special reference to China and Japan. *Twice a week; second semester.* Professor Greene.

HORTICULTURE

At least two years of collegiate work in horticulture and allied subjects and specific preparation for the chosen topics are required for entrance upon major work in this department.

Courses for Graduates

102. Pomology.—Special problems in the adaption, propagation, cultivation, or pruning of small fruits. *Both semesters. One to two units.* Professor Crandall.

103. Olericulture.—Special problems in the structure, cultural requirements, and improvements of vegetables. *Both semesters. One to two units.* Professor Blair, Professor Lloyd.

108. Pomology.—Special problems in the relationship, adaptation, improvement, propagation, cultivation, pruning, protection, preservation, or marketing of orchard fruits. *Both semesters. One to two units.* Professor Blair, Professor Crandall.

Courses for Graduates and Advanced Undergraduates

8. Orcharding.—A comprehensive study of pomaceous fruits and drupaceous or stone fruits. *Five times a week; first semester.* Professor Crandall.

12. Evolution of Horticultural Plants.—History, botanical classification, and geographical distribution of cultivated plants; modification under culture; theoretical causes and observed factors that influence variation, particularly food supply, climate, and cross-fertilization. *Three times a week; first semester.* Professor Crandall.

18. Experimental Horticulture.—Methods and difficulties in horticultural investigations; the planning of experiments; recording and interpretation of results. *Five times a week; second semester.* Professor Blair, Assistant Professor Pickett, Mr. Watkins.

HOUSEHOLD SCIENCE

Students who wish to do graduate work in household science should specialize in either the scientific or the economic phase of the subject. In either case they must offer an equivalent of twenty hours of household science as given in the University of Illinois, with a minimum of two years of chemistry, including organic chemistry, a year of biological science, and a year of either economics or sociology.

Courses for Graduates

101. Home Economics.—A study of the origin and development of home economics, with particular reference to its industrial, educational, and sociological aspects. *Twice a week; both semesters. One unit.* Professor Bevier.

102. Special Investigations.—Problems in the application of the principles of bacteriology, chemistry, and physiology to the ordinary processes used in the preparation of food; problems in nutrition. *Twice a week; both semesters. Two units.*

Professor Bevier, Assistant Professor Goldthwaite, Assistant Professor Wheeler.

103. Seminar.—Recent advances in nutrition. *Once a week; second semester. One-half unit.* Assistant Professor Wheeler.

Courses for Graduates and Advanced Undergraduates.

4. Food and Nutrition.—An application of the principles of pure science to the problems of food and nutrition. The problems may be physiological, chemical or bacteriological. *Five times a week; first semester.*

Assistant Professor Goldthwaite, Assistant Professor Wheeler.

5. Dietetics.—*Three times a week; both semesters.*

Assistant Professor Goldthwaite.

19. Infant Nutrition.—*Twice a week; second semester.*

Assistant Professor Wheeler.

Prerequisite: Household Science 5.

ITALIAN

[See Romance Languages.]

LATIN

[See Classics.]

MATHEMATICS

Students entering upon graduate study with a major in mathematics must have had twenty-five semester hours of undergraduate work in mathematics, including a year's course in calculus and a course in theory of equations, or in differential equations. They should be able to read German and French.

Students taking a first minor in mathematics are expected to have completed a course in calculus and are required to take four units of work beyond the calculus; students taking a second minor are required to complete at least two units of mathematical work beyond the calculus.

Courses for Graduates

100. Seminar.—*Three times a week; both semesters. One to two units.*

Professor Townsend, Professor Miller, Professor Rietz, Associate Professor Shaw, Assistant Professor Sisam, Assistant Professor Emch.

101. Functions of Real Variables.—*Three times a week; both semesters. One unit.* Professor Townsend.

[Not given in 1915-16.]

104. Expansions in Fundamental Functions.—This course develops the theory of integral equations far enough to arrive at methods of expansion of arbitrary functions in terms of the characteristic functions of a given nucleus. *Three times a week; both semesters. One unit.* Associate Professor Shaw.

Prerequisite: Mathematics 16-17.

105. Calculus of Variations.—A study of the necessary and sufficient conditions for a maximum or minimum in simple and isoperimetric problems. *Three times a week; both semesters. One unit.* Dr. Crathorne.

110. Elliptic Functions.—The elements of the theory with applications to geometry and mechanics. Introduction to the theory of the elliptic modular functions. *Three times a week; both semesters. One unit.* Assistant Professor Carmichael.

111. Automorphic Functions.—The first semester is devoted mostly to the group-theoretic side of the theory; the second semester is concerned with the function-theoretic developments and applications. *Three times a week; both semesters. One unit.* Assistant Professor Emch.

[Not given in 1915-16.]

113. Theory of Linear Differential Equations.—*Three times a week; both semesters. One unit.* Dr. Crathorne.

[Not given in 1915-16.]

120. Elementary Theory of Groups.—*Three times a week; both semesters. One unit.* Professor Miller.

[Not given in 1915-16.]

121. Theory of Groups.—This course presupposes about one year's work in group-theory. *Three times a week; both semesters. One unit.* Professor Miller.

124. Theory of Numbers.—*Three times a week; both semesters. One unit.* Dr. Wahlin.

129. Theory of Statistics.—The general methods of statistical investigation and the application of the principles developed to

problems in economics, sociology, and biology. *Three times a week; both semesters. One unit.* Professor RIETZ.

130. INVARIANTS AND HIGHER PLANE CURVES.—Special study is made of curves of the third and fourth order. *Three times a week; both semesters. One unit.* Assistant Professor SISAM.

[Not given in 1915-16.]

131. ALGEBRAIC SURFACES.—The application of homogenous co-ordinates and the theory of invariants to geometry of three dimensions; the general theory of surfaces; the special properties of surfaces of the third and fourth order. *Three times a week; both semesters. One unit.* Assistant Professor SISAM.

[Not given in 1915-16.]

135. DIFFERENTIAL GEOMETRY.—Applications of the calculus to the general theory of curves and surfaces based primarily on the use of Cartesian co-ordinates. Relation of the theory of surfaces to the theory of invariants of a pair of quadratic differential forms. *Three times a week; both semesters. One unit.*

Assistant Professor SISAM.

141. VECTOR METHODS.—*Three times a week; both semesters. One unit .* Associate Professor SHAW.

[Not given in 1915-16.]

142. GENERAL ALGEBRA.—*Three times a week; both semesters. One unit .* Associate Professor SHAW.

[Not given in 1915-16.]

Courses for Graduates and Advanced Undergraduates

7, 9. DIFFERENTIAL AND INTEGRAL CALCULUS.—*Five times a week, first semester; three times a week, second semester.*

Professor RIETZ, Associate Professor SHAW, Assistant Professor SISAM, Assistant Professor EMCH, Assistant Professor CARMICHAEL, Dr. CRATHORNE, Dr. BORGER, Dr. LYTLE, Dr. WAHLIN, Dr. KEMPNER, Dr. DENTON, Dr. CHITTENDEN, Dr. WILSON.

8. DIFFERENTIAL AND INTEGRAL CALCULUS.—This course may be counted for graduate credit by students whose major is chemistry. *Five times a week; first semester.*

Professor MILLER, Mr. SMITH.

10. THEORY OF EQUATIONS AND DETERMINANTS.—This course may be counted for graduate credit by students whose major is a

subject other than mathematics. *Three times a week; second semester.* Professor MILLER.

16-17. DIFFERENTIAL EQUATIONS AND ADVANCED CALCULUS.—Ordinary and partial differential equations supplemented by the consideration of special topics of calculus not ordinarily included in a first course, particularly those of value in the applications of mathematics. *Three times a week; both semesters.*

Professor TOWNSEND.

Prerequisite: Mathematics 7 and 9.

19. SOLID ANALYTICAL GEOMETRY.—*Three times a week; second semester.* Assistant Professor SISAM.

21. METHOD OF LEAST SQUARES.—*Twice a week; first semester.* Professor STEBBINS.

24-25. FUNCTIONS OF A COMPLEX VARIABLE.—A general introduction to the theory of function of a complex variable. *Three times a week; both semesters.* Professor TOWNSEND.

27-28. PROJECTIVE GEOMETRY.—Axiomatic foundations, cross ratio, projective pencils and ranges, etc. Application to mechanics. *Three times a week; both semesters.* Assistant Professor EMCH.

31. ACTUARIAL THEORY.—The application of probability to life contingencies, the construction and graduation of mortality tables, the elements of fire insurance and the calculation of premiums and reserves. *Three times a week; first semester.* Professor RIETZ.

[Not given in 1915-16.]

32. HISTORY OF MATHEMATICS.—A general view of the historical development of the elementary subjects and an outline of the rise and growth of the higher mathematics chiefly in the nineteenth century. *Twice a week; second semester.* Dr. LYTLE.

[Not given in 1915-16.]

33. MODERN ALGEBRA.—This course includes a consideration of the following topics: theory of matrices; system of linear equations; bilinear and quadratic forms; properties of polynomials; algebraic invariants; and elementary divisors. *Three times a week; both semesters.* Dr. BORGER.

[Not given in 1915-16.]

40. FUNDAMENTAL CONCEPTS OF MATHEMATICS.—Development of the number concept; concepts of unity; aggregate, order and correspondence; irrationals and limits, transcendence of e and n; parallel axiom and non-euclidian geometries; ruler and compass

constructions; function; logic of mathematics. *Twice a week; second semester.* Dr. LYTLE.

MECHANICAL ENGINEERING

The prerequisite for graduate work in mechanical engineering is the equivalent of the undergraduate courses required for the degree of Bachelor of Science in mechanical engineering in the branches of the subject in which registration is desired.

Courses for Graduates

106. HEAT MOTORS.—The advanced theory of the internal combustion motor, and of the steam turbine; the general principles and methods of refrigeration. *Twice a week; second semester. One unit.* Professor GOODENOUGH.

107. THERMODYNAMICS.—The general principles of thermodynamics and their application to the solution of engineering problems. *Twice a week; first semester. One unit.* Professor GOODENOUGH.

109. MACHINE DESIGN.—The general principles of rational design; the application of mechanics of materials. Individual problems. *Twice a week; either semester. One unit.* Professor LEUTWILER.

112. LABORATORY INVESTIGATIONS.—Special investigations of problems relating to the combustion of fuels, boiler economy, steam engines and turbines, and similar subjects. *Three times a week; both semesters. One and one-half units.* Professor RICHARDS, Professor HARDING.

114. DYNAMICS OF MACHINERY.—Advanced problems; whirling and vibration of shafts; theory of governors; fly wheels; force and mass reduction; stresses in rotating masses. *Twice a week; both semesters. One unit.* Professor GOODENOUGH.

Courses for Graduates and Advanced Undergraduates

The following are accepted as minor courses for students who are not candidates for advanced degrees in mechanical engineering:

12. THERMODYNAMICS.—*Five times a week; second semester.* Professor GOODENOUGH.

15. GAS POWER ENGINEERING.—Internal combustion engines;

liquid and gaseous fuels and their combustion; gas producers. *Three times a week; first semester.* Professor RICHARDS.

26. HEATING AND VENTILATION.—The theory and the application of the principles of heating and ventilation to modern practice. *Three times a week; second semester.*

Assistant Professor WILLARD.

30. MECHANICS OF MACHINERY.—Mechanisms and mechanical movements; cams, gears, valve gears, and quick-return motions; graphical constructions for displacement, velocity, and acceleration; kinetics of the steam engine mechanism and similar mechanisms. *Five times a week; second semester.* Mr. DENT.

32. POWER TRANSMISSION.—The theory and practice of power transmission by means of shafting, belts, ropes, cables, water, air, gas, and steam; the measurement and storage of power. *Three times a week; second semester.* Professor RICHARDS.

43. ENGINEERING DESIGN.—Theory of machine design, with application. *Five times a week; first semester.*

Professor LEUTWILER.

44. ENGINEERING DESIGN.—Study of the correct design and commercial application of special tools, fixtures, jigs, dies, and gauges used in modern high production manufacturing. *Twice a week; second semester.* Professor LEUTWILER.

52. POWER PLANT DESIGN.—Study and design of some form of steam power plant. *Three times a week; second semester.*

Professor LEUTWILER.

54. INDUSTRIAL PLANT DESIGN.—*Three times a week; second semester.* Professor HARDING.

65. POWER LABORATORY.—Experiments on engines, turbines, gas engines, pumps, boilers, injectors, air compressors, hoisting appliances, heating apparatus, and the refrigerating machines. *Three times a week; first semester.* Professor HARDING.

66. POWER LABORATORY.—Special research work in the mechanical engineering laboratory. Open to seniors only. *Twice a week; second semester.* Professor HARDING.

MECHANICS, THEORETICAL AND APPLIED

The prerequisite for graduate work in theoretical and applied mechanics is the equivalent of the undergraduate courses required

for the degree of Bachelor of Science in theoretical and applied mechanics in the branches of the subject in which registration is desired.

Courses for Graduates

101. ANALYTICAL MECHANICS.—The fundamental premises of mechanics; methods of treatment and attack; the more complex problems and applications. *Twice a week; first semester. One unit.* Assistant Professor MOORE.

102. RESISTANCE OF MATERIALS.—Advanced work on the properties of materials used in engineering construction and the methods of determining these properties. *Twice a week; second semester. One unit.* Assistant Professor MOORE.

103. HYDRAULICS AND HYDRAULIC ENGINEERING.—The laws of hydraulics and their application to engineering problems; hydraulic power and its development; design and investigation. *Twice a week; second semester. One unit.*

Professor TALBOT, Assistant Professor MOORE.

104. EXPERIMENTAL WORK IN LABORATORY OF APPLIED MECHANICS.—(a) Laboratory investigation in the materials-testing laboratory; (b) experimental work in hydraulic laboratory, and the study of the laws of hydraulics, the development of power, and various hydraulic problems. *Twice a week; both semesters. One-half to two units.* Professor TALBOT, Assistant Professor MOORE.

105. EXPERIMENTAL AND ANALYTICAL WORK IN REINFORCED CONCRETE.—Research work in reinforced concrete. *Twice a week; both semesters. One and one-half units or more.*

Professor TALBOT.

Courses for Graduates and Advanced Undergraduates

1. ANALYTICAL MECHANICS.—A course especially designed for students in Arts and Sciences. Lamb's *Statics* and Lamb's *Dynamics. Three times a week; first semester.* Mr. ENSIGN.

2. ANALYTICAL MECHANICS.—A continuation of course 1. Lamb's *Dynamics. Three times a week; second semester.*

Mr. ENSIGN.

METEOROLOGY

[See GEOLOGY]

MINERALOGY

[See GEOLOGY]

MINING ENGINEERING

The prerequisite for graduate work in mining engineering is the equivalent of the undergraduate courses required for the degree of Bachelor of Science in mining in the branches of the subject in which registration is desired.

In addition to the regular University laboratories, the laboratory connected with the investigation of mining conditions in Illinois now being carried on jointly by the Department of Mining Engineering, the State Geological Survey, and the United States Bureau of Mines, is available for graduate instruction in coal washing, ore dressing, blasting and explosives and mine ventilation.

Courses for Graduates

100. SEMINAR.—*Once a week; both semesters. One unit.*
Professor STOEK.

101. ADVANCED MINING METHODS.—Coal and ore fields of the United States; methods and economics of mining; utilization, marketing, storage, and transportation of coal and ores. *Twice a week; both semesters. One unit.* Professor STOEK.

102. ADVANCED PREPARATION OF COAL AND ORES.—Settling ratios, laws of crushing; sorting vs. sizing; mill and washing problems. *Twice a week; both semesters. One unit.*
Assistant Professor HOLBROOK.

103. HISTORY OF MINERS' ORGANIZATIONS.—*Twice a week; both semesters. One unit.* Professor STOEK.

104. MINING REPORTS.—Law of the apex, the classification of coal and ore lands; conservation of mineral resources; mine examination and report. *Twice a week; both semesters. One unit.*
Professor STOEK.

105. WELFARE WORK AND EDUCATION AMONG MINE EMPLOYEES.—The organization and operation of mining institutes, night classes, welfare, mine rescue and first-aid work. *Twice a week; both semesters. One unit.* Professor STOEK.

Courses for Graduates and Advanced Undergraduates

5. Mine Ventilation.—*Three times a week; first semester.* Professor Stoek.

9. Preparation of Coal and Ores.—*Three times a week; first semester.* Assistant Professor Holbrook.

13. Utilization of Fuels.—*Twice a week; second semester.* Assistant Professor Holbrook.

19. Ore and Coal Preparation.—*Three times a week; first semester.* Assistant Professor Holbrook.

21. Mine Examination and Valuation.—*Twice a week; first semester.* Professor Stoek.

MUNICIPAL AND SANITARY ENGINEERING

The prerequisite for graduate work in municipal and sanitary engineering is the equivalent of the undergraduate courses required for the degree of Bachelor of Science in municipal and sanitary engineering in the branches of the subject in which registration is desired.

Courses for Graduates

102. Water Supply Engineering.—Advanced work in water supply engineering will be arranged to suit the requirements of individual classes. *One to three times a week; first or second semester. One unit.* Professor Talbot.

103. Sewerage.—General sewerage design and construction, sewerage systems, and hydraulics of sewers, are examples of the topics taken up. *Once or twice a week; second semester. One unit.* Professor Talbot.

106. Water Purification, Sewage Disposal and General Sanitation.—The design, construction, and operation of water purification plants and of sewage disposal works, and the study of existing plants. Experimental work on water filters, septic tanks, etc.; garbage disposal and general sanitation. *Once a week; second semester. Half unit.* Professor Talbot.

PALEONTOLOGY

[See Geology]

PHILOLOGY

[See Classical Philology, under Classics, Comparative Philology under Germanic Languages, and Romance Philology, under Romance Languages]

PHILOSOPHY

A student entering upon graduate work in philosophy must have had a thorough general course in the history of philosophy, a course in logic, and a general course in psychology.

Courses for Graduates

103. Seminar in Ethics.—British ethics from Hobbes to Sidgwick. *Twice a week; both semesters. One unit.*

Professor Daniels.

107a-107b-107c. History of Philosophy.—A: The philosophy of Plato and Aristotle. *Twice a week; both semesters. One unit.*

B: The philosophy of Descartes, Spinoza, and Leibnitz. *Twice a week; first semester. One unit.*

C: The philosophy of Kant and Schopenhauer. *Twice a week; second semester. One unit.*

The subjects for 1915-16 are 107b and 107c.

Professor Daniels.

108a-108b-108c. Seminar in Contemporary Philosophy.—A: Idealism. *Twice a week; both semesters. One unit.*

B: Realism and pragmatism. *Twice a week; both semesters. One unit.*

C: The philosophy of Bergson. *Twice a week; both semesters. One unit.*

The subject for 1915-16 is 108a. Professor Bode.

Courses for Graduates and Advanced Undergraduates

3. History of Ancient and Medieval Philosophy.—*Three times a week; first semester.* Professor Daniels.

4. History of Modern Philosophy.—*Three times a week; second semester.* Dr. Shepherd.

7. Ethics.—The beginnings and growth of morality; the fun-

damental questions of ethical theory; typical social and economic problems of the present. *Three times a week; second semester.* Professor DANIELS.

11. PHILOSOPHY OF RELIGION.—The philosophical interpretation of religious consciousness. Among the topics considered are: God; revelation; inspiration; dogma; prayer; faith; immortality; the problem of evil; the relation of morality and religion. *Twice a week; second semester.* Professor DANIELS.

15. BRITISH PHILOSOPHERS OF THE EIGHTEENTH CENTURY.—Locke, Berkeley and Hume. *Three times a week; first semester.* Professor BODE.

16. PHILOSOPHY OF PRAGMATISM.—*Three times a week; second semester.* Professor BODE.

18. PHILOSOPHERS OF THE NINETEENTH CENTURY.—A survey of philosophical tendencies in materialism, naturalism, idealism and pragmatism. *Three times a week; first semester.* Dr. SHEPHERD.

19. RELIGIOUS THOUGHT IN THE EIGHTEENTH AND NINETEENTH CENTURIES.—*Three times a week; first semester.* Dr. SHEPHERD.

PHYSICS

The prerequisite for graduate work in physics is a college course in general physics with a year's laboratory course in introductory physical measurements. The student who is to do major work in physics should also have had additional courses in physics or teaching experience, unless the training in his minor subjects, mathematics or chemistry, has been strong and complete. He should also have a knowledge of French and German sufficient to use references in these languages. The courses named below are those open for candidates for the Master's or Doctor's degree. A large part of the last year's work of the candidate for the Doctor's degree is investigational, along either the experimental or the theoretical side of physics. In addition to these major graduate courses, the courses in elementary dynamics, heat, light, electrical measurements, and introductory electrical theory, are arranged with certain additions for graduate credit. The "intermediate" courses on heat, light, and electricity and magnetism may be offered by students making a minor in physics.

Courses for Graduates

121. Recent Advances in Physics and the Electron Theory.—A series of lectures of a non-mathematical character describing and discussing some of the more recent discoveries in physics. Some of the topics presented in 1914-15 were: the molecular and atomic structure of matter, the universal occurrence of electrons; determination of the e/m and v of the electron; ditto for the ion; determination of the elementary charge of the electron by means of the fog method, by Brownian movements, by radio-activity. *Three times a week; second semester. Half unit.*

Associate Professor Knipp, Associate Professor Kunz.

[Not given in 1915-16.]

123. Sound.—The course includes discussion of wave motion, forced vibrations, the velocity and energy relations of sound waves, resonance, vibrations of strings and organ pipes, etc. *Three times a week; second semester. Three-quarters unit.*

Associate Professor Watson.

124. Conduction of Electricity Through Gases.—A laboratory course with collateral reading and discussions in which the student performs quantitatively with standard apparatus, together with such additional apparatus as he may find it necessary to construct, the classical experiments relating to discharge phenomena. In the second semester an original problem is taken up and carried to completion. *Three times a week; both semesters. One to two units.* Associate Professor Knipp.

126. Physics Colloquium.—Weekly meetings of the instructors and advanced students of the department for the presentation and discussion of papers on current problems in physics. Attendance on this colloquium is expected of all the graduate students. *Once a week; both semesters. One-quarter to one-half unit.*

127a. Electron Theory.—The present problems of radiation are the subjects of this course, which is a phase of the electron theory. The course is partly a seminar course, in which the students are expected to take an active part. *Twice a week; first semester. One unit.* Associate Professor Kunz.

131. Investigation of Special Problems.—Advanced laboratory or design and calculation. A problem worked out with the

advice and direction of the instructor. *Two to four times a week; both semesters. One to two units.*

Professor CARMAN, Associate Professors KNIPP, WATSON, KUNZ, Assistant Professor SCHULZ, and Dr. WILLIAMS.

132. MATHEMATICAL PHYSICS.—Special phases in theoretical physics.

(a) DYNAMICS.—Newton's equations, general methods of integration, potential-theory, potential of the ellipsoid, application to celestial mechanics, the principles of least constraint, of virtual work, of D'Alembert, of Hamilton, are some of the subjects in the first part of the course. In the second part, special problems of hydrodynamics and of electricity will be treated. *Three times a week; both semesters. Two units.* Associate Professor KUNZ.

(b) ELECTRODYNAMICS.—Problems from Jean's *Mathematical Theory of Electricity and Magnetism;* the potential theory: spherical harmonics, conjugate functions, and some theorems of the vector analysis; capacities, coefficients of self, and mutual induction, etc. Continued in the following year in course 132d.

Associate Professor KUNZ.

[Not given in 1915-16.]

132c. THERMODYNAMICS AND KINETIC THEORY OF MATTER.—The two fundamental principles developed and applied to various physical and chemical phenomena; the theory of chemical equilibrium; the Nernst theorem; the direct method of Carnot's cycle together with the method of the thermodynamic potentials and the derived functions; Maxwell's theory of the distribution of velocities in a gas; Boltzman's H theory; the theory of radiation, especially Planck's theory of quanta. *Both semesters. One to two units.* Associate Professor KUNZ.

[Not given in 1915-16.]

132d. THEORY OF ELECTRICAL OSCILLATIONS AND CYLINDRICAL HARMONICS.—*Four times a week; both semesters. One to two units.* Associate Professor KUNZ.

[Not given in 1915-16.]

133. SEMINAR.—*Three or five times a week; both semesters. One to three units.*

Professor CARMAN, Associate Professors KNIPP, WATSON, KUNZ, Assistant Professor SCHULZ.

Courses for Graduates and Advanced Undergraduates

4a-4b. Electrical and Magnetic Measurements.—A course of exact electrical and magnetic measurements with accompanying theory. *Twice a week; both semesters.* Assistant Professor Knipp.

Prerequisite: Physics 1a-1b, 3a-3b, or 7a-7b, 8a-8b and Mathematics 7, 9.

14a. Introduction to Theoretical Physics.—Dynamics.—This course is intended to put in systematic form the fundamental facts and concepts of motion, mass and force, with discussion and solving of problems from pure and applied physics. *Three times a week; first semester.* Professor Carman.

14b. Introduction to Theoretical Physics.—Elementary Thermodynamics and Wave Motion.—The general phenomena of heat and of wave energy are discussed with calculus methods. *Three times a week; second semester.* Professor Carman.

20. Light.—Special phenomena; modern theories; readings in texts of Drude, Wood, and Preston. *Twice a week; first semester.* Assistant Professor Schulz.

22. Light-Photometry.—The scientific principles and methods of photometry; the comparison of various light sources with standards; the determination of reflective power and transmission coefficients; spectrophotometry, etc. *Two to five times a week; first semester.* Assistant Professor Schulz.

23. Sound.—The course includes a consideration of the origin, propagation, velocity, and interference of sound, the vibration of strings, rods, and gas columns, and the physical theory of music and speech. *Three times a week; second semester.* Associate Professor Watson.

25. Heat.—Advanced laboratory work in heat involving mostly the theory and methods of measurement of temperatures by thermocouples, resistance thermometers and optical pyrometers. *Twice a week; second semester.* Associate Professor Watson.

[Not given in 1915-16.]

26. Architectural Acoustics.—Acoustics of Auditoriums including discussions of the common acoustical defects and their cures, the transmission of sound through materials, and the acous-

tical properties of building materials. *Once a week; second semester.* Associate Professor WATSON.

Prerequisite: Physics 1a-1b, 3a-3b; or 9a-9b, 10a-10b.

30. INTRODUCTION TO THEORETICAL ELECTRICITY.—Electrical and magnetic phenomena discussed with calculus methods. This is a course for advanced students in physics, chemistry, mathematics and engineering. *Three times a week; second semester.*

Associate Professor KNIPP.

31a-31b. SPECIAL PROBLEMS IN ADVANCED PHYSICAL MEASUREMENTS.—*Two or three times a week; both semesters.*

Professor CARMAN, Associate Professors KNIPP and WATSON, Assistant Professor SCHULZ and Dr. WILLIAMS.

32. ELECTRICITY AND MAGNETISM.—Electrical measurements; special methods of measuring self and mutual inductance, capacity, etc., measurement of low resistance; standardization and calibration work. *Twice a week; second semester.* Dr. WILLIAMS.

PHYSIOLOGY

The prerequisite for graduate work in Physiology is two years' work in chemistry and two in biology. The biology should include at least one year in the fundamentals of zoology and embryology.

Courses for Graduates

103. RESEARCH.—Facilities are offered in the physiological laboratory for special lines of investigation. *Once a week; both semesters. One or two units.* Assistant Professor BURGE.

Courses for Graduates and Advanced Undergraduates

1. HISTOLOGY.—This course includes a study of the fundamental mammalian tissues, and the microscopic anatomy of the organs. *Five times a week; first semester.*

Assistant Professor BURGE and Dr. BEARD.

2. PHYSIOLOGY.—This course includes a study of the physiology of nerve and muscle, circulation, respiration, secretion, digestion and metabolism. *Five times a week; second semester.*

Assistant Professor BURGE and Dr. BEARD.

5. SPECIAL PHYSIOLOGY.—This course includes work in the physiology of special sense, optics and advanced work in circulation, blood and respiration. *Five times a week; both semesters.*

Assistant Professor BURGE.

7. Journal Club.—*Once a week; both semesters.*
Assistant Professor Burge.

PHYSIOGRAPHY

[See Geology]

POLITICAL SCIENCE

Graduate work in political science is conducted in the following special fields: (1) Political theory; (2) international law and diplomacy; (3) comparative government; (4) constitutional law, administrative law and jurisprudence; (5) municipal administration.

To be admitted to take political science as a major subject, the student must have done at least 18 hours of undergraduate work in political science, economics, or history, not less than six hours of which must have been in political science. To take political science as a minor he must have had at least nine hours' work in this field, including courses the equivalent of I and III in the announcement of the College of Liberal Arts and Sciences.

If a student making political science his major is taking both of his minors in other departments, one of them must be either in history, economics or sociology.

Several courses given in other departments are so closely related to those in political science that graduate students whose major is political science may be permitted on petition to take such courses as part of their major work. In this connection attention may also be called to the technical courses given by the Department of Muncipal and Sanitary Engineering.

Courses for Graduates

101. History of Political Theories.—Political theories of Aristotle, Machiavelli, Hobbes, Locke, Montesquieu, Rousseau, and others; evolution of American political ideas. *Twice a week; first semester. One unit.* Professor Garner.

102. The Nature of the State.—*Twice a week; first semester. One unit.* Professor Garner.

[This course is given in alternate years; course 101 will be given in its place in 1915-16].

103. Seminar in Political Science and Public Law.—*Once a week; both semesters.* Members of the Department.

106. Special Topics in International Law.—The topics chosen for 1915-16 relate to certain questions of war law, such as the rights and duties of neutrals, contraband, right of search, capture, continuous voyage, transfers of flag, blockades, etc. *Twice a week; second semester. One unit.* Professor Garner.

112. Special Topics in Public Administration.—Comparative studies in national, municipal, and local administration. The topics vary from year to year. *Twice a week; second semester. One unit.* Professor Fairlie.

capture, continuous voyages, transfer of flag, blockades, etc. *Twice*

113. Special Topics in State Administration.—Administrative reorganization; development of newer functions; centralization and home rule; methods of law enforcement; relations between state, federal, and local agencies. *Twice a week; second semester. One unit.* Assistant Professor Mathews.

Courses for Graduates and Advanced Undergraduates

4. Municipal Government.—*Three times a week; first semester.* Mr. Story.

5. Constitutional Law of the United States.—*Three times a week; first semester.* Mr. Cushman.

6. International Law.—*Three times a week; first semester.* Professor Garner.

7. American Diplomacy.—*Three times a week; second semester.* Assistant Professor Mathews.

9. Principles of Jurisprudence.—The nature and sources of law; historical development and comparison of Roman law and the English legal system; English common law in the United States; relation between statutes and judicial decisions; classification of law. *Twice a week; second semester.* Professor Fairlie.

10. Administrative Law in the United States.—Separation of governmental powers and the delegation of legislative power; federal and state administrative organs; methods of enforcing governmental commands; remedies of the individual against unlawful action by public officers. *Three times a week; second semester.* Mr. Cushman.

11. Constitutional Aspects of Social and Industrial Problems.—The police; constitutional limitations upon legislation con-

cerning the public health and safety; the control of public service corporations and combinations of capital and labor. *Three times a week; first semester.* Mr. CUSHMAN.

12. NATIONAL ADMINISTRATION IN THE UNITED STATES.—A study of the President and his Cabinet; the executive departments and the administrative services of the national government, etc. *Three times a week; first semester.* Professor FAIRLIE.

13. STATE ADMINISTRATION IN THE UNITED STATES.—*Three times a week; first semester.* Assistant Professor MATHEWS.

14. POLITICAL PARTIES.—A study of the development of political parties and their organization and influence on the government mainly of Great Britain and the United States, with attention to recent legislation in primaries and nomination methods in this country. *Twice a week; first semester.* Professor FAIRLIE.

18. LEGISLATION IN THE UNITED STATES.—Nature of legislative power; principles of representation; legislative organization, procedure and practices; bill drafting; legislative reference bureaus; popular law making; tendencies in legislation. *Three times a week; second semester.* Mr. STORY.

21. BRITISH GOVERNMENT.—Political institutions in the United Kingdom and British Possessions. *Three times a week; first semester.* Professor FAIRLIE.

22. CONTINENTAL EUROPEAN GOVERNMENT.—A comparative study of the national political systems of France, Germany, Italy, Austria-Hungary and Switzerland. *Three times a week; second semester.* Professor GARNER.

28. PROBLEMS OF CONTEMPORARY POLITICS.—The initiative and the referendum; state socialism; universal suffrage; local self-government; judicial reform; the Monroe Doctrine, etc. *Twice a week; second semester.* Mr. STORY.

34. MUNICIPAL PROBLEMS.—Municipal administration in the United States and Europe; municipal organization and relations to the state; municipal ownership and regulation of public utilities; city planning and housing; police and sanitary administration; municipal finances. *Three times a week; second semester.* Professor FAIRLIE.

PSYCHOLOGY

Graduate students who elect psychology as their major subject must have had standard courses, of university grade, both in general psychology and in the psychological laboratory. One general university course is the minimum requirement for graduate students who apply to the department for a minor subject.

Courses for Graduates

103. RESEARCH.—Experimental and historical investigations. *Both semesters. One half to two units.*
Professor BENTLEY, Dr. RUCKMICH, Dr. RAHN.

105. SEMINAR.—For the discussion of current topics considered in their historical setting. *Once a week, two hours; both semesters. Half unit.* Professor BENTLEY.

Courses for Graduates and Advanced Undergraduates

5-6. COMPARATIVE PSYCHOLOGY.—Study of consciousness in the animal forms. Laboratory drill and research. *Twice a week; both semesters.* Professor BENTLEY.

8. MEMORY AND ASSOCIATION.—Analysis of the associative consciousness: conditions of learning. *Twice a week; second semester.* Dr. RAHN.

9. PHYSIOLOGICAL PSYCHOLOGY.—An empirical study of the psycho-physical relationships. Lectures and discussions. *Three times a week; first semester.* Dr. RAHN.

12-13. MINOR PROBLEMS.—The formulation of methods suitable to new problems. *Two to five times a week; both semesters.*
Professor BENTLEY, Mr. RUCKMICH.

14. SOCIAL PSYCHOLOGY.—The social consciousness, its factors and conditions: the psychology of peoples *(Völkerpsychologie). Twice a week; first semester.* Dr. RAHN.

15. THE PSYCHOLOGICAL BASIS OF MUSIC.—Tonal quality, melody, rhythm, consonance, harmony: psychology of musical appreciation and performance. *Twice a week; first semester.* Dr. RUCKMICH.

17. THE HISTORY OF PSYCHOLOGY.—*Twice a week; second semester.* Dr. RUCKMICH.

19-20. SYSTEMATIC PSYCHOLOGY.—The nature of psychological

analysis; mental integration. *Three times a week; both semesters.*
Dr. RUCKMICH, Dr. RAHN.

21-22. SPECIAL STUDIES.—Individual investigation for advanced students. *Three times a week; both semesters.*
Professor BENTLEY, Dr. RUCKMICH, Dr. RAHN.

RAILWAY ENGINEERING

[See TRANSPORTATION]

RHETORIC

[See ENGLISH]

ROMANCE LANGUAGES AND LITERATURES

Before entering upon the study of Romance languages as a major for an advanced degree, the candidate must have had a total of at least thirty semester hours of college work in these languages. Eighteen of these hours must be in one of these three languages, French, Italian, or Spanish, but no candidate will be received who has not had at least twelve hours in French. In addition a candidate must have had a good training in Latin, and be able to read ordinary German prose.

Before entering upon the study of Romance Languages as a first or second minor, for an advanced degree, the candidate must have had a total of at least sixteen hours of college work in the language desired. He must also be able to read ordinary German prose.

FRENCH

Courses for Graduates

101. OLD FRENCH EPIC LITERATURE.—Critical reading and interpretation of the greater national and courtly epics. Collateral study of the history of these types of medieval literature. *Twice a week; both semesters. One unit.* Professor OLIVER.

102. OLD FRENCH LYRIC AND PROSE LITERATURE.—Critical interpretation of the earlier Old French dramatists, didactic, chronicle and lyric writers. Collateral study of the history of these types of medieval literature. *Twice a week; both semesters. One unit.*
Professor OLIVER.

[Not given in 1915-16].

103. Seventeenth Century Prose Writers.—French culture, society and prose literature of the seventeenth century. The great preachers and moralists. Jansenism and Port Royal. The formation of the classic ideals. *Once a week; both semesters. Half unit.* Professor Oliver.

[Not given in 1915-16].

104. Eighteenth Century Prose Writers.—Society, culture and prose literature of the eighteenth century. The attack upon the classic ideals. Growth of the revolutionary spirit. First movements towards romanticism. *Once a week; both semesters. Half unit.* Professor Oliver.

105. The Fifteenth and Sixteenth Centuries in France.—A study of the non-dramatic literature of the period. *Twice a week; both semesters. One unit.* Associate Professor Carnahan.

[Not given in 1915-16].

106. Early French Drama.—A study of the origins of the drama in France, and its development up to the Renaissance. *Twice a week; both semesters. One unit.* Associate Professor Carnahan.

110. Introduction to Romance Philology.—Historical Phonology and Morphology of the Romance languages. *Twice a week; both semesters. One unit.* Professor Fitz-Gerald.

119. Old French Phonology and Morphology.—Development of Old French from Vulgar Latin. *Twice a week; both semesters. One unit.* Assistant Professor Blondheim.

120. French Lexicography.—Selected problems in Old French word-history. *Once a week; both semesters. Half unit.* Assistant Professor Blondheim.

125. Seminar.—Research work in preparation for theses in the field of the Romance languages. *Twice a week; both semesters. One unit.* The Various Members of the Department.

Courses for Graduates and Advanced Undergraduates.

10. General Survey of French Literature.—An introduction to more extended study of special periods and authors. *Three times a week; both semesters.* Associate Professor Carnahan.

17. Nineteenth Century Drama.—Plays by Hugo, Dumas, Augier, Sardou, Hervieu, Brieux, Rostand, etc.; dramatic criticism. *Twice a week; both semesters.* Professor McKenzie.

24. The Drama of the Seventeenth and Eighteenth Cen-

turies.—Corneille, Racine, Molière, Voltaire, Marivaux, Sedaine, Beaumarchais. *Twice a week; both semesters.* Professor Oliver.

26. French Literary Criticism.—Special emphasis is laid upon the seventeenth and the nineteenth centuries, in connection with the development of classicism and romanticism. *Twice a week; both semesters.* Assistant Professor Blondheim.

Italian

Course for Graduates

140. Italian Literature of the Thirteenth and Fourteenth Centuries.—Dante, Petrarch, Boccaccio. *Twice a week; both semesters. One unit.* Professor McKenzie.

Course for Graduates and Advanced Undergraduates

2a-2b. Literary Course.—Selected readings from the works of the principal Italian writers of the nineteenth century. *Twice a week; both semesters.* Dr. Moore.

Spanish

Courses for Graduates

131. Oldest Monuments of the Spanish Language; Origins of Spanish Poetry.—Historical grammar and palæography; critical interpretation of texts. *Twice a week; both semesters. One unit.* Professor Fitz-Gerald.

[Not given in 1915-16].

132. The Novela of the Golden Age.—A study of the political and social conditions in Spain from 1560 to 1700 is followed by an examination of the various kinds of prose fiction produced in this period, with special attention to *Don Quixote* and the *Novelas Exemplares* of Cervantes. *Twice a week; both semesters. One unit.* Professor Fitz-Gerald.

133. Origins of the Spanish Novela and of the Comedia.—The development of Spanish prose fiction and of Spanish dramatic art for the period previous to the Golden Age. *Twice a week; both semesters. One unit* Professor Fitz-Gerald.

[Not given in 1915-16].

134. The Spanish Ballad.—*Twice a week; both semesters. One unit.* Dr. Seymour.

[Not given in 1915-16].

135. The Modern Novel in Spain.—Development of the modern novel in Spain from the middle of the nineteenth century up to the present time. Comparative study of the development of the novel in Spain, France and Italy. *Twice a week; both semesters. One unit.* Dr. Seymour.

Course for Graduates and Advanced Undergraduates

11a-11b. The Spanish Drama of the Sixteenth and Seventeenth Centuries.—The principal dramatists of the classical period, especially Lope de Vega, Calderón, Tirso de Mólina, and Ruiz de Alarcón. *Twice a week; both semesters.* Dr. Seymour.

SCANDINAVIAN LANGUAGES

[See Germanic Languages]

SOCIOLOGY

Preparation for graduate work in sociology must include at least the equivalent of twelve semester hours in the social sciences, of which at least three must be in sociology, and three in the principles of economics. The remainder may be in any combination of these two subjects, or of history and political science.

Courses for Graduates

101. Sociological Method.—The method of advancing sociological knowledge; adaptability to sociological investigation of certain methods described in Pearson's *Grammar of Science,* Wundt's *Methodenlehre, zweite abtheilung,* Seignobos' *La Méthode Historique Appliquée aux Sciences Sociales,* Bernheim's *Historische Méthode,* Spencer's *Study of Sociology,* and Giddings' *Inductive Sociology. Three times a week; first semester. One unit.* Professor Hayes.

102. The Development of Sociology.—A course in the works of writers who have contributed most to the development of sociology. *One session, two hours, each week; both semesters. One unit.* Professor Hayes.

150. Seminar.—Exercises in the detection and statement of problems; preparation of theses. *One session of two hours each week; both semesters. One to two units.* Professor Hayes.

(Note: One of the three courses above described will be omitted in 1915-16; which one is omitted will depend upon the election of students.)

Courses for Graduates and Advanced Undergraduates

2. Social Control.—The methods by which society shapes the conduct, opinions, and sentiments of its members. *Three times a week; first semester.* Professor Hayes.

11. Principles of Sociology.—Fundamental principles and main teachings of sociology. *Three times a week; first semester.* Professor Hayes.

[Not given in 1915-16.]

3. Social Evolution.—A course for students who desire acquaintance with the comparative method of dealing with questions of theory in the social sciences. *Three times a week; second semester.* Professor Hayes.

8. Charities.—The evolution of modern organized philanthropy, public and private; causes and prevention of poverty; organization and management of charitable institutions. *Three times a week; first semester.* Dr. Stevens.

9. Criminology.—Nature, causes, and treatment of the criminal; evolution of modern method of criminal procedure and penology; recent experiments and tendencies. *Three times a week; second semester.* Dr. Stevens.

10. Problems of Population.—Immigration; race problems; conditions affecting public health; selective agencies affecting the population type; eugenics; theories and policies of population. *Three times a week; first semester* Dr. Stevens.

14. Social Statistics.—Social investigation and research. Social and community surveys. The verification of sociological laws and principles by means of statistical method. *Three times a week; second semester.* Dr. Stevens.

15. The Family.—Evolution of the family and marriage; educational, moral, and political significance of the family at different stages of social development. *Twice a week; both semesters.*

[Not given in 1915-16.]

26. Social Education.—Education as a factor in social progress. Present day educational policy and organization in the light of theoretical and applied sociology. *Three times a week; second semester.*

[Not given in 1915-16.]

12. Labor Problems.—See Economics 12.

21. Socialism and Social Reform.—See Economics 21.

SPANISH

[See ROMANCE LANGUAGES]

TRANSPORTATION

ENGINEERING

The prerequisite for graduate work in railway engineering is the equivalent of the undergraduate courses required for the degree of Bachelor of Science in railway engineering in the branches of the subject in which registration is desired.

Courses for Graduates

102. LOCOMOTIVE DESIGN.—Study and analysis of modern practice concerning steam pressure, compounding, superheating, etc. *Once a week; both semesters. One unit.*

Assistant Professor SNODGRASS.

106. LOCOMOTIVE OPERATION.—Study and determination of train resistance and locomotive tractive effort. The application of these and other matters in the establishment of tonnage ratings. *Once a week; both semesters. One unit.* Professor SCHMIDT.

108. ELECTRIC RAILWAYS.—This course deals with the design, selection, and operation of electric railway equipment. *Once a week; both semesters. One unit.* Assistant Professor BUCK.

110. RAILWAY LOCATION.—This course is essentially a study of the effects of the location of a railway upon its earning capacity. It deals with the engineering and economic problems met with in original location, as well as in the relocation and reduction of grades of existing lines. *Once a week; both semesters. One unit.*

Mr. COMSTOCK.

Courses for Graduates and Advanced Undergraduates

6. LOCOMOTIVES.—*Four times a week; second semester.*

Professor SCHMIDT.

33. ECONOMIC THEORY OF RAILWAY LOCATION.—*Four times a week; second semester.* Mr. COMSTOCK.

64. ELECTRIC RAILWAY PRACTICE.—*Three times a week; first semester.* Assistant Professor BUCK.

65. ELECTRIC RAILWAY ECONOMICS.—*Four times a week; second semester.* Assistant Professor BUCK.

Economic and Administrative

Courses for Graduates

101. Railway Rate Policy.—An inquiry into the problems of railway rate making, from the points of view both of theory and practice, followed by a critical review of governmental regulation of rates. *Twice a week; first semester. One unit.*

Professor Dewsnup.

[Not given in 1915-16].

102. The Significance of the Financial Policy of American Railways.—A discussion of the problems of railway capitalization and its regulation, reasonable rates, physical valuation, inter-railway finance, etc. *Twice a week; second semester. One unit.*

Professor Dewsnup.

103. The Literature of Railway Economics.—A critical reading course, beginning with Dr. Lardner's *Railway Economy* of 1850. *Twice a week; first semester. One unit.* Professor Dewsnup.

ZOOLOGY

At least sixteen semester hours of college work in zoology are required for entering upon major graduate study in this subject. Under special circumstances advanced work in closely allied subjects may be accepted in lieu of the fourth semester's work in zoology. When zoology is chosen for a minor the courses listed for graduates and undergraduates must be preceded by at least one full year's undergraduate work in zoology.

For the prosecution of graduate study in zoology a reading knowledge of German and French is indispensable and familiarity with Latin and Greek is of great advantage.

Every candidate for the doctor's degree is expected to spend at least one summer in study at the seashore. To facilitate this plan an investigator's room has been provided at the Woods Hole Marine Biological Laboratory, where members of the department are afforded research facilities without cost to themselves. Application for the use of this room should be made to the head of the department early in the year. Similar facilities are afforded at the Harpswell Marine Laboratory.

Courses for Graduates

102. Selected Topics from Vertebrate Morphology.—The origin of vertebrates, segmentation of the head; morphology of special systems. *First semester. Half unit.* Professor Kingsley.

110-110a. Economic Ecology.—Application of principles of physiology and ecology to problems of fisheries and pollution; insect pests and weather, forestry and conservation, etc. 110 *twice a week;* 110a assigned reading and reports. *Half unit each.*
Assistant Professor Shelford.

[Given in 1915-16 and alternate years.]

111. Experimental Ecology.—Repetition of published experiments in physiology and ecology. Student selects a topic on animal reactions or measurement of osmotic pressure, temperature, acidity, conductivity, etc., with modern apparatus. *One-half to two units.* Assistant Professor Shelford.

115. Factors of Individual and Racial Development.—Experimental embryology; regeneration; heredity; variation; evolution. *Twice a week; both semesters. One unit.*
Professor Zeleny.

117. Faunistic Zoology.—Problems in taxonomy, distribution, and ecology; field work; conference; lectures. Work is favored by a natural history survey of the State now in progress at the University. Students have advantage of collections, library, apparatus and operation of this survey. *Twice a week; both semesters. One to two units.* Professor Smith.

Individual Research Courses

121. Zoological Problems. *One to two units.* Professor Ward.

122. Vertebrate Morphology. *One to two units.*
Professor Kingsley.

123. Faunistic and Systematic Zoology. *One to two units.*
Professor Smith.

124 Experimental Zoology. *One to two units.*
Professor Zeleny.

125. Animal Ecology and Behavior. *One to two units.*
Assistant Professor Shelford.

127. Theories of Animal Phylogeny.—Relations of various groups of animals; signification of so-called intermediate forms; study of invertebrate larval forms and of theories of descent based

on them. Lectures; assigned readings; laboratory. *Once or twice a week; both semesters. One unit.* Professor WARD.

[Given in 1915-16 and alternate years.]

Courses for Graduates and Advanced Undergraduates

3. MICROSCOPICAL TECHNIQUE AND GENERAL VERTEBRATE EMBRYOLOGY.—Theory and practice of microscopical technique. *Twice a week; first semester.* Professor KINGSLEY.

6. VERTEBRATE ORGANOGENY.—Development of the organs of the vertebrate body. (A continuation of course 3.) *Three times a week; second semester.* Professor KINGSLEY.

8a-8b. THESIS INVESTIGATION.—Individual work on assigned topics. *Both semesters.* Various Instructors.

11. EXPERIMENTAL ECOLOGY AND GEOGRAPHY.—The physiology of environmental relations, facts, principles, and methods of analysis of behavior. World and regional aspects of behavior and ecology including animal distribution as related to climate and vegetation. *Two to five times a week; both semesters.* Assistant Professor SHELFORD.

17. FIELD ZOOLOGY.—Collection, preservation, and identification of common representatives of lower vertebrates and of various groups of land and fresh-water invertebrates; identification work on living and preserved material; observations on the habits and life histories of selected forms. *Three times a week; first semester.* Professor SMITH.

18. ADVANCED FIELD ZOOLOGY.—More restricted problems in connection with the local fauna; taxonomic or distributional problems. (A continuation of course 17.) *Two to five times a week; second semester.* Professor SMITH.

20a-20b. CURRENT LITERATURE.—*Once a week; both semesters.* Professor ZELENY.

21a-21b. INTRODUCTION TO ZOOLOGICAL RESEARCH.—Investigation of topics, usually repeating the work of earlier investigators. *Two to five times a week; both semesters.* Professor WARD.

22-23. MORPHOLOGY OF VERTEBRATES.—The skeleton and the brain, the cranial nerves, and the eye and ear. *Two to five times a week; both semesters.* Professor KINGSLEY.

25-26. EXPERIMENTAL ZOOLOGY.—Experimental embryology; regeneration; heredity; variation; evolution. *Two to five times a week; both semesters.* Professor ZELENY.

INDEX

Admission, 9
Advisers, 11
Agronomy 23
Amount of work, 11
Animal Husbandry, 25
Architecture, 27
Astronomy, 28
Attendance, 11

Bacteriology, 28
Board of Trustees, 5
Botany, 29

Calendar, 1915-16, 6
Ceramics, 30
Character of graduate work, 13
Chemistry, 32
Civil Engineering, 38
Classics, 39
Classical Philology, 42

Dairy Husbandry, 43
Degrees, 13
  Doctor's, 15
  Master's, 13
    Professional, in Engineering, 14
Diploma fee, 22
Dittenberger Classical Library, 21
Doctor's degree, 15
  In Engineering, 18
  Special regulations. See name of department, as Classics, History, etc.

Economics, 44
Education, 46
  Aron Library, 22
Electrical Engineering, 48
Engineering, master's degree in, 14
  Architectural, 27
  Civil, 38
  Electrical, 48
  Mechanical, 72
  Mechanics, Theoretical and Applied, 73
  Mining Engineering, 75
  Municipal and Sanitary, 76
  Railway, 92
English, 49
  Literature and Language, 52
  Rhetoric, 53
Entomology, 54

Entrance requirements, 9, 10
Establishment of Graduate School, 9
Examination for Doctor's degrees, 16
Expenses, fees, 22

Faculty, Executive, 8
Fees, 22
Fellowships and Scholarships, 19
  Research, in Engineering, 20
French, 87

Geology, 55
German, 57
Germanic Languages and Literatures, 57
Graduates of University, 9
  of other institutions, 9
Graduate assistants, 12
Graduate Club, 23
Greek, 40
Gröber Library, 21

Harpswell Marine Laboratory, 93
Heyne Library, 21
History, 61
History of Graduate School, 9
Horticulture, 66
Household Science, 67

Incidental fees, 22
Italian, 89

Journalism, 53

Laboratory fees, 22
Latin, 41
Libraries
  Aron, 22
  Dittenberger, 21
  Gröber, 21
  Heyne, 21
  Law, 21
  Mason, 21
  Natural History, 21
  University, 20
  Vahlen, 21
Listener's courses, 12

Mason Library, 21
Master of Arts, degree of, 13
  See also special requirements of various departments, as Economics, Chemistry, etc.

Master of Science, degree of, 13
Master's degree in engineering, 14
Mathematics, 68
Matriculation fee, 22
Mechanical Engineering, 72
Mechanics, Theoretical and Applied, 73
Mining Engineering, 75
Miscellaneous courses, 12
Municipal and Sanitary Engineering, 76

Natural History Library, 21

Paleontology, 76
Philology, 77
Philosophy, 77
Physics, 78
Physiology, 82
Physiography, 83
Political Science, 83
Professional degrees in Engineering, 14
Psychology, 86

Railway Engineering, 87
Registration, 11
Research fellowships, Engineering Experiment Station, 20
Residence study, 12
Rhetoric, 53
Romance Languages and Literatures, 87
  French, 87
  Gröber Library in, 21
  Italian, 89
  Spanish, 89
Rooms and board, 23

Scandinavian Languages, 60
Scholarships and fellowships, 19
Sociology, 90
Spanish, 89
Staff members, 12

Theses, Doctor's, 17
Theses, Master's, 13
Transfer of credit, 12, 16
Transportation, 92
  Engineering, 92
  Economic and Administrative, 93
Trustees, Board of, 5

Vahlen Library, 21

Wood's Hole Marine Laboratory, 93

Zoology, 93

PUBLICATIONS

Of The

UNIVERSITY OF ILLINOIS

Following is a partial list of the publications issued at the University:

1. *The University Studies.* Miscellaneous Series, Social Science Series, Biological Monographs, and Literature and Language Series. Each issue is priced separately.

2. *The Journal of English and Germanic Philology,* published quarterly. Three dollars a year.

3. *The Bulletin of the Engineering Experiment Station.*

4. *The Bulletin of the Agricultural Experiment Station.*

5. *The Bulletin of the State Laboratory of Natural History.*

6. *The Bulletin of the State Geological Survey.*

7. *The Bulletin of the State Water Survey.*

8. *Report of the State Entomologist.*

9. *The general series,* including the University catalog and the circulars of the undergraduate colleges, the Graduate School, the College of Law, the Schools of Dentistry, Pharmacy, Education, Railway Transportation, Business Administration, the Library School and the Summer Session.

10. *The Bulletin of the Illinois Association of Teachers of English.*

UNIVERSITY OF ILLINOIS-URBANA
3 0112 046392285